Increased Biodiesel Use in Missouri

Prepared for:

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Table 1, Acronyms

Acronym	Description
CRD	Crop Reporting District
BD	Biodiesel
SBO	Soybean Oil
EIA	U.S. Energy Information Administration

Executive Summary

This project evaluates the impacts of a new fuel standard policy in Missouri in comparison with current situation. The project evaluates these impacts from different interrelated perspectives: diesel and biodiesel consumption in the state, Missouri out-of-state biodiesel shipments, biodiesel production, soybeans and soybean oil usage, the number of processors, the number of Missouri biodiesel producers, and impact on current biodiesel and soybean oil production capacity. Under the new biodiesel fuel policy, the industry is expected to grow, hence, the corresponding additional economic activity from increased production of soybean, processing of soybean, and the construction of a new plant is estimated. In addition to evaluating these core components, this project includes a Dynamic Flow Analysis (DFA) for biodiesel in Missouri. The DFA models the flow of biodiesel from soy-based biodiesel production facilities in Missouri and selected abutting states. Moreover, assuming the fuel standard policy will take place, the transportation cost impact is determined and the benefits to animal agriculture are discussed.

The state of Missouri is considering adoption of biodiesel standards that would lead to increased consumption of biodiesel in Missouri. This study establishes the baseline case for biodiesel use for 2019-2028. The study also analyzes two use scenarios: Scenario 1 includes B10 blends being used in the months of April to October beginning in 2023 and continuing through 2028; Scenario 2 models B10 being used in April to October of 2023-2024 and B20 blends of biodiesel being used April to October for 2025 through 2028. In addition, there are two subcases considered: scalping (in which in-state consumption takes precedent over out-of-state shipments) and no-scalping (in which in-state consumption would be met and out-of-state shipments from Missouri plants also would be continued at 2019 levels with adjustment for trend increases. Three models were developed for this analysis, Missouri Biodiesel Model (Missouri baseline biodiesel capacity only), Regional Biodiesel Model (Missouri baseline biodiesel capacity plus unused capacity from nearby eight states and selected regions within those states), Neighbor Biodiesel Model (Missouri baseline biodiesel capacity plus all unused capacity from the nearby eight states).

Under the baseline case of the Missouri Biodiesel Model, Missouri maintains a 5% blend of biodiesel in its diesel fuel mix. In-state consumption rises from 74 million gallons in 2019 to 86 million gallons by 2028. Out-of-state shipments rise from 96 million gallons in 2019 to 111 million gallons in 2028. Existing capacity at Missouri's biodiesel plants is sufficient to meet this demand with production rising from 170 million gallons per year in 2019 to 197 million gallons (93% of capacity) in 2028.

In Scenario 1 (B10), Missouri in-state biodiesel consumption rises from 74 million gallons in 2019 to 137 million gallons by 2028. Under Scenario 1A (scalping) Missouri biodiesel production would increase to its current capacity of 213 million gallons per year. But that level

of production would be insufficient to continue making all the out-of-state markets that Missouri biodiesel plants currently serve. Out-of-state shipments would decline to 76 million gallons per year as in-state consumption grows to 137 million gallons per year.

Under Scenario 1B (no-scalping) Missouri in-state consumption rises from 74 million gallons per year in 2019 to 137 million gallons per year by 2028. Out-of-state markets are expected to need 111 million gallons per year for a total demand on Missouri biodiesel plants of 248 million gallons per year by 2028.

In Scenario 2 (B10/B20), Missouri in-state consumption rises from 74 million gallons per year to 237 million gallons in 2028. In addition, out-of-state markets would still need 111 million gallons per year for a total demand of 348.6 million gallons. In Scenario 2A, Missouri biodiesel production rises to current capacity of 213 million gallons. However, this amount would be still be about 25 million gallons short of meeting in-state demand and would result in loss of all out-of-state markets.

Under Scenario 2B, in-state consumption rises from 74 million gallons of biodiesel per year to 237 million gallons per year and if out-of-state markets were maintained another 111 million gallons of biodiesel would be needed for a total market demand of 349 million gallons.

To address the potential shortfalls of production to meet the biodiesel consumption stimulated by the Missouri biodiesel standards, two additional scopes of analysis were conducted: a regional model that considers biodiesel production in the counties included in the USDA Crop Reporting Districts (CRDs) that abut Missouri and a Neighboring State model that includes of the biodiesel production in all of the states that abut Missouri.

In the Regional Model it is assumed that 26% of biodiesel production capacity in the abutting states is available for production of biodiesel to meet the demands of Missouri in-state use and out-of-state markets. This amounts to 260 million gallons of available capacity. In Regional Model -Scenario 1, there is sufficient existing capacity to meet the increased in-state consumption (137 million gallons) and to maintain supplies to out-of-state markets (111 million gallons). Total biodiesel use in Missouri and out-of-state shipments would use 95% of the available biodiesel production capacity of the region.

In the Regional Model, Scenario 2A, total available biodiesel production capacity is limited to existing capacity (260 million gallons per year). By 2028, Missouri in-state consumption would use 237 million gallons. Without construction of additional capacity, out-of-state shipments would decline to 23 million gallons by 2028.

In the Regional Model, Scenario 2B, Missouri In-state consumption rises to 237 million gallons of biodiesel by 2028 and out-of-state shipments would be 111 million gallons for a total demand of 348.6 million gallons per year. Under Scenario 2B, the combination of Missouri in-state demand and out-of-state shipments would require 134% of regional production capacity. This suggests that there could be sufficient demand to consider construction of a new 50 million gallon biodiesel production facility in Missouri. Under scenario 2 it is assumed that additional production for out-of-state markets beyond that supplied by expanded regional production would come from existing biodiesel plants in neighboring states.

An economic impact analysis was conducted for (1) the impacts of increasing existing Missouri biodiesel production from 170 million gallons per year to 213 million gallons per year; (2) the impacts of building additional biodiesel storage to facilitate increased biodiesel consumption during April to October; and (3) the impacts of building and operations of a new 50 million gallon per year biodiesel plant with 10 million gallons of storage.

Since there is already a biodiesel presence in Missouri, this scenario looked at the economic impact of an increase in the industry. This assumes that the existing facilities are able to ramp up production to utilize unused capacity of 43 million gallons. Included in this scenario is a new biodiesel plant producing 50 million gallons per year. For this scenario there is a need to increase storage for biodiesel by 53 million gallons in addition to the 10 million gallons of storage on the new biodiesel plant which would cause additional construction impacts.

Construction impacts are one-time occurrences and not annual ongoing impacts. Using the methodology and assumptions outlined in this report, the estimated total value-added impact for construction, as shown in Table 7 was $88.2 million. Estimates of value added is an accurate indicator of the biodiesel industry's ability to improve economic prospects for the local economy. In terms of jobs, 1,825 total jobs will be supported in Missouri because of construction for storage and the new plant. $194.8 million in total sales economic activity occurs within Missouri.

Table 2, Total Impact Results, Construction Impact of New Plant and Increased Biodiesel at Existing Plants

Construction				
Impact Type	Employment	Labor Income	Value Added	Sales
Direct Effect	1,129	$68,624,056	$27,363,713	$82,450,903
Indirect Effect	227	$13,944,867	$22,010,233	$42,967,948
Induced Effect	469	$22,159,209	$38,797,698	$69,426,736
Total Effect	1,825	$104,728,132	$88,171,644	$194,845,587

Under this scenario there is an operations impact as well as the construction impact. This assumes that the existing facilities are able to ramp up production to utilize unused capacity of 43 million gallons. This scenario included a new biodiesel plant producing 50 million gallons per year. The operations impacts of the new plant and increased production from existing facilities are annual impacts which would occur every year, not just one-time impacts like construction. Using the methodology and assumptions outlined in this report, the estimated total value added impact for operations for the first year, as shown in Table 8, was $116.1 million. Estimates of value added is an accurate indicator of the biodiesel industry's ability to improve economic prospects for the local economy. In terms of jobs, 1,076 total jobs would be supported in Missouri each year because of additional operations from existing plants and the operations of the new plant. $446.1 million in total sales economic activity would occur within Missouri each year.

Table 3, Total Impact Results, Operations for First Year Impact of New Plant and Increased Biodiesel at Existing Plants

Operations for First Year				
Impact Type	Employment	Labor Income	Value Added	Sales
Direct Effect	192	$20,365,600	$39,603,259	$293,551,326
Indirect Effect	596	$30,814,456	$52,638,504	$109,914,314
Induced Effect	288	$13,597,257	$23,819,591	$42,623,221
Total Effect	1,076	$64,777,313	$116,061,354	$446,088,861

Introduction

Given several comparative advantages to other geographies, Missouri is a major producer of biodiesel. More specifically, the biodiesel that is produced in Missouri comes primarily from the conversion of soybean oil through the transesterification process. Utilizing locally processed soybean oil from locally produced soybeans is a natural way to add value to the soybean value-chain in Missouri, while also reducing reliance upon imported fuel. Furthermore, with trends signifying more goods ordered online being delivered to homes via truck transportation, the use of higher biodiesel blends would offset increasing demand for transportation fuels.

The primary components of this economic research include:

1. Determine, using "what-if" analysis, additional demand for soybeans (relative to the current situation) if higher biodiesel blends as part of a fuel standard were to be adopted in Missouri.
2. Determine what impact higher biodiesel blends would have on the number of Missouri biodiesel producers.
3. Determine the impact of higher biodiesel blends on supply, demand and movement of soybean oil to Missouri biodiesel producers.
4. Determine the impact of higher use of soybean oil as a feedstock for biodiesel on soybean crush and any resulting change in movement of soybeans throughout Missouri and surrounding areas.
5. Determine what impact higher biodiesel blends would have on the number of soybean processors.
6. Determine the economic impact of a larger biodiesel industry in the State of Missouri.

Additionally, you will find analysis on diesel usage and dynamic flow by county, discussion of transportation cost impacts, and the potential effects on animal agriculture.

In this analysis, biodiesel sales (highway and non-highway) were projected using the following three alternative settings:

Consumption Baseline

Missouri currently uses approximately 5% biodiesel in the diesel blends sold within the state. The consumption baseline assumes that a 5% biodiesel blend (B5) would continue throughout the projected period.

Scenario 1/Policy Proposal 1

The 5% biodiesel blend (B5) would continue through March 2023. Then, from April 2023 to December 2028, the biodiesel blend would be 10% (B10) from April to October and B5 the rest of the year (November to March).

Scenario 2/Policy Proposal 2

The 5% biodiesel blend (B5) would continue through March 2023. From April 2023 to March 2025, the biodiesel blend would be B10 during April to October and B5 from November to March. Then, from April 2025 to December 2028, the biodiesel mix would be 20% (B20) from April to October, and B5 during the rest of the year.

Monthly biodiesel consumption varies for the Baseline case, Scenario 1 and Scenario 2 according to the biodiesel blend stipulated by the policy. Overall, monthly biodiesel consumption is estimated by:

- Monthly Biodiesel Consumption =Monthly diesel consumption X Percent,
- Where percent is equal to the biodiesel blend based on the policy.

Based on Baseline, Scenario 1, and Scenario 2, impacts on soybean oil (SBO) demand and soybean usage/crush were estimated.

For more information on methodology and assumptions used for each of the Scenarios, please see Appendix A - Methodology.

Results

Analysis of Policy Proposals

The analysis in this section evaluates the additional demand for soybeans if higher biodiesel blends (B5, B10, and B20) as part of a fuel standard were adopted in Missouri. As of now, Missouri does not report volumes of biodiesel sold in the state, therefore this data was estimated based on volumes of Missouri gross diesel (highway and non-highway) reported for fuel tax purposes and published by Missouri Department of Revenue.

It is estimated that in 2019, Missouri used a total of 1.478 billion gallons of diesel fuel. Highway use accounted for 1.207 billion gallons of use and non-highway use totaled 271 million gallons. It is estimated that 73.9 million gallons of biodiesel (B-100) were used in Missouri diesel fuel blends in 2019. Highway use accounted for 60.35 million gallons of the biodiesel and non-highway use totaled 13.54 million gallons.

Missouri Current and Projected Diesel Sales

Figure 1 presents the historical (January 2006 through October 2019) and projected (November 2019 to December 2028) Missouri diesel consumption. Highway diesel represents the largest volume (80%) of total diesel consumption in the state. During the historical period diesel consumption was about 1.4 billion gallons, on average. Diesel consumption is expected to grow at an annual rate of 1.0166% per year from 2019 to 2028. Projections indicate that by 2028 about 1.7 billion gallons diesel per year would be consumed in Missouri.

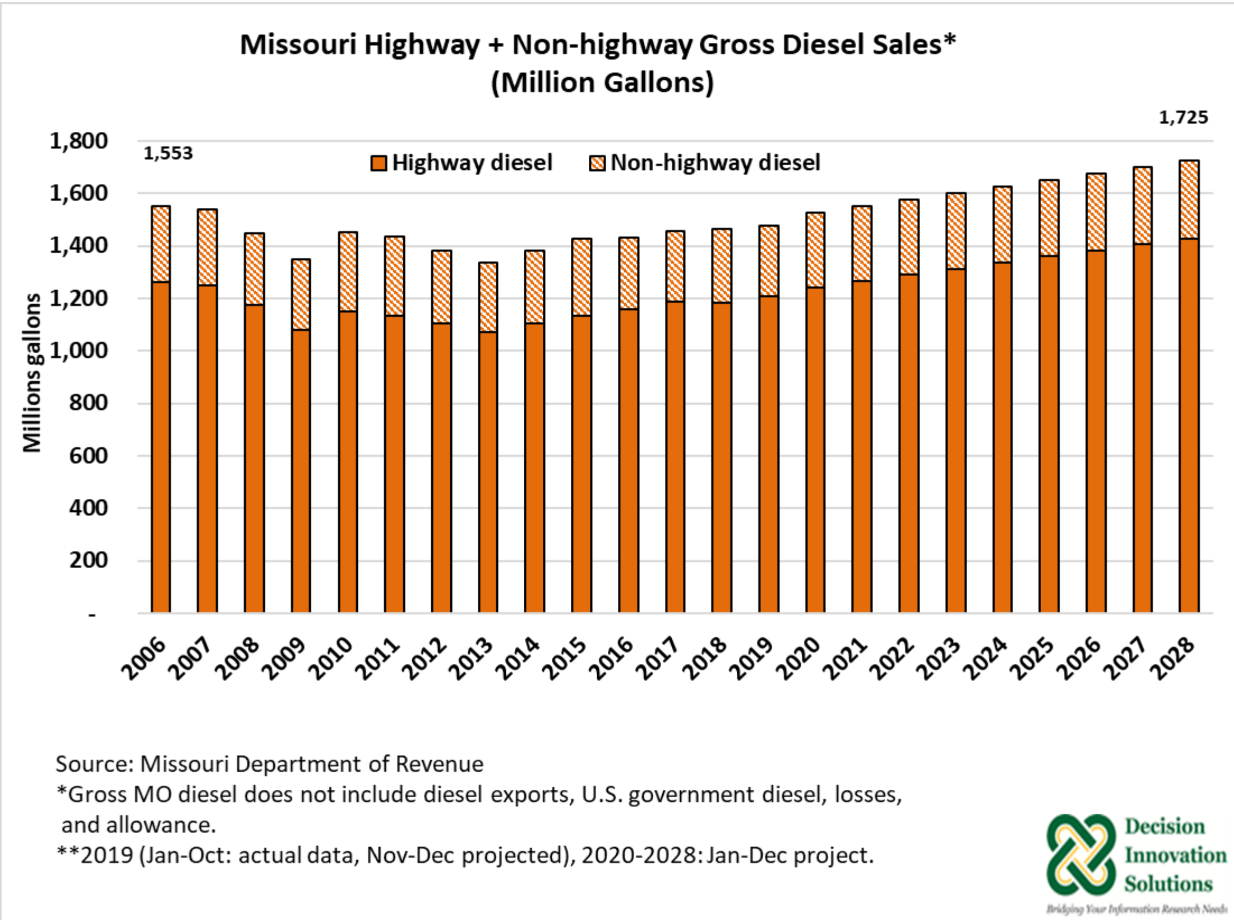


Figure 1, Missouri Highway + Non-highway Gross Diesel Sales (Million Gallons)

Missouri Current and Projected Biodiesel Sales

The biodiesel blend in Missouri diesel consumption increased from less than 1% (0.63%) in 2006 to almost 5% (4.91%) by 2016. These estimates were based on the annual average biodiesel mix at the national level during the historical period, which was applied to the Missouri diesel consumption (sales) data (i.e., biodiesel consumption = diesel consumption X biodiesel percent in the blend at the national level).

Missouri biodiesel consumption during the projected period was based on the three alternative consumption settings related to the biofuel policy: Baseline case (B5), Scenario 1 (B10), and Scenario 2 (B20). Projected biodiesel consumption was estimated as: projected diesel consumption X biodiesel percent in the blend according to each of the alternative settings.

In the Baseline case, B5 started in 2017 and would remain unchanged during the entire projected period. Under this case, Missouri's total biodiesel consumption would increase 17% from 73.9 million gallons in 2019 to 86.3 million gallons in 2028 (see Figure 2).

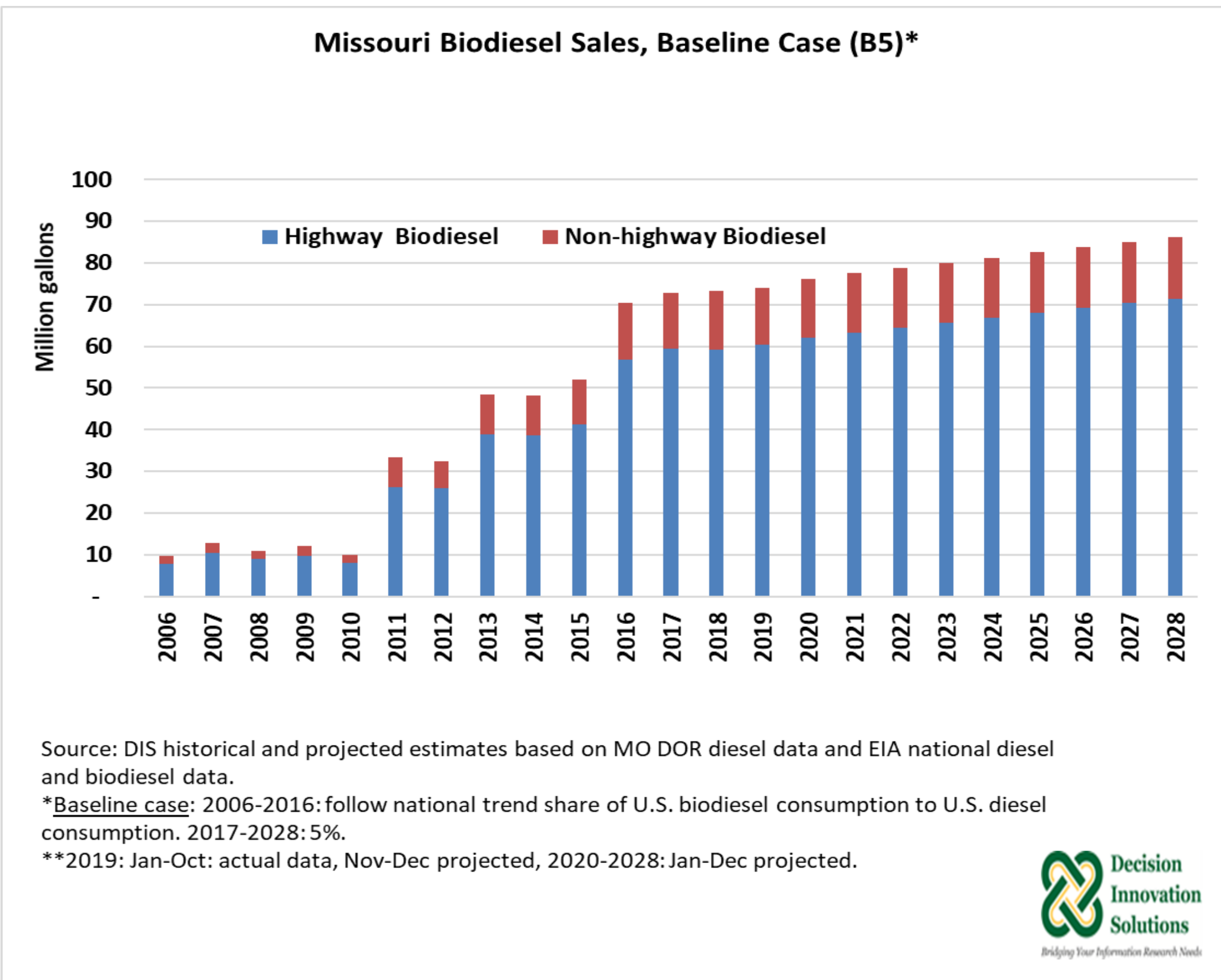
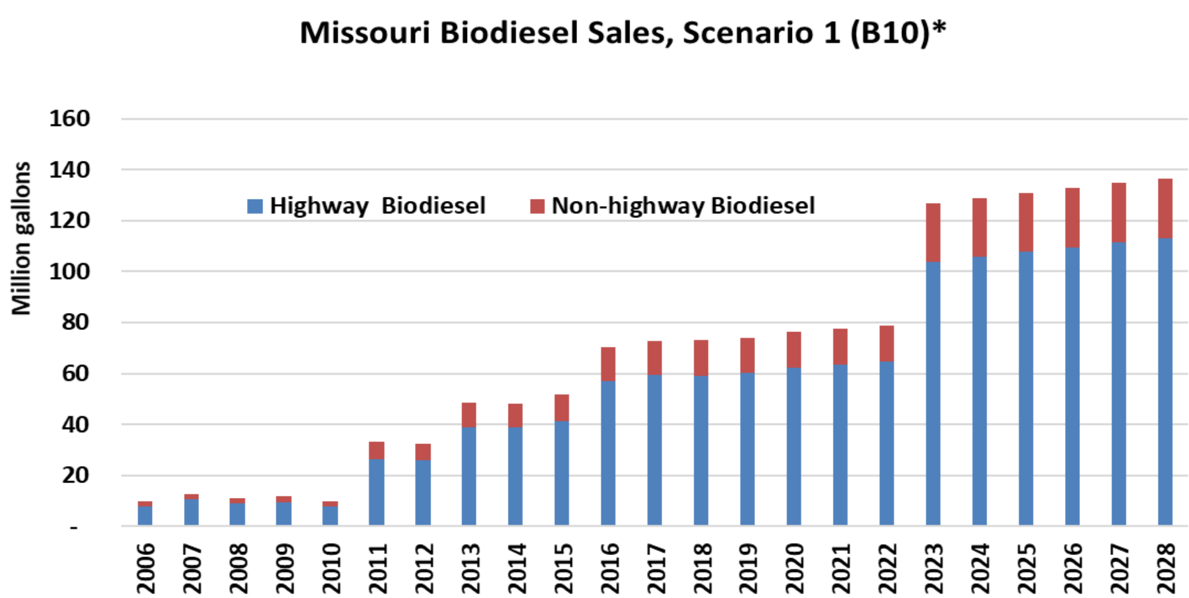


Figure 2, Missouri Biodiesel Sales, Baseline Case (B5)

Under Scenario 1 (B10), biodiesel consumption would jump from a blend of 5% to a 10% blend (B10) starting in April 2023. B10 would be consumed during April to October of the projected period, while B5 would be consumed during the rest of the year (November to March). Under Scenario 1, Missouri total biodiesel consumption would increase 85% from 73.9 million gallons (2019) to 136.6 million gallons (2028) (see Figure 3).



Source: DIS historical and projected estimates based on MO DOR diesel data and EIA national diesel and biodiesel data.
*Scenario 1: 2006-2016: follow national trend share of U.S. biodiesel consumption to U.S. diesel consumption. Jan 2017-Mar 2023: 5%. 2023-2028: Apr-Oct: 10%, Nov-Mar: 5%
**2019: Jan-Oct: actual data, Nov-Dec projected, 2020-2028: Jan-Dec projected.

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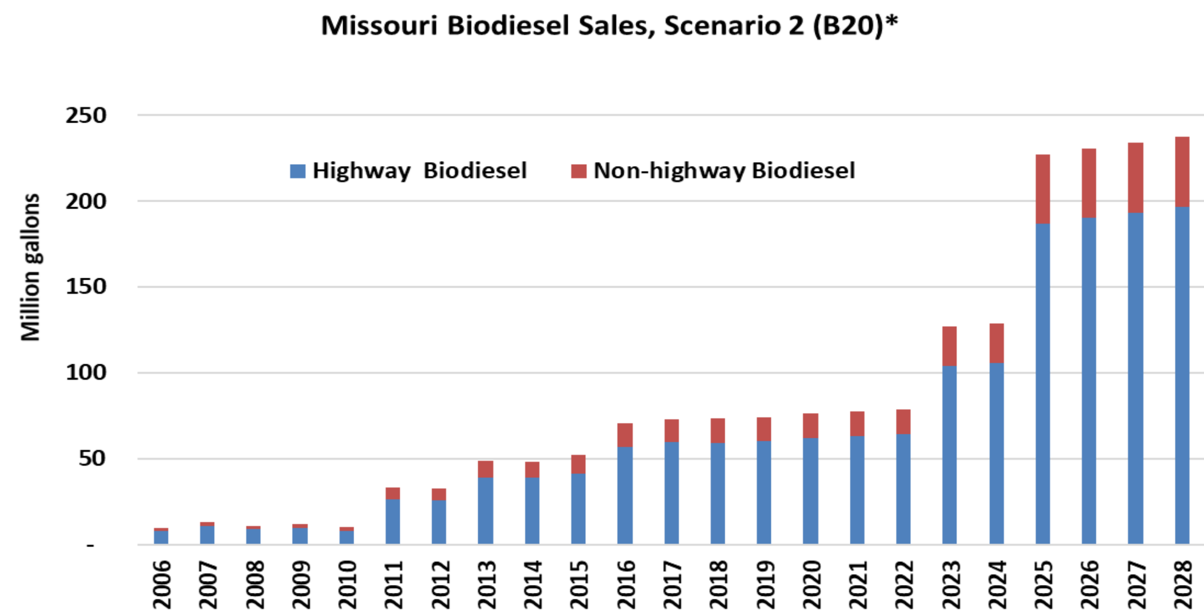
Figure 3, Missouri Biodiesel Sales, Scenario 1 (B10)

Under Scenario 2 (B20), B5 consumption would continue through March 2023. From April 2023 to March 2025, the biodiesel blend would be B10 during April to October and B5 from November to March. Then, from April 2025 to December 2028, the biodiesel mix would be 20% (B20) from April to October, and B5 during the rest of the year. Under Scenario 2, Missouri total biodiesel consumption would increase 221% from 73.9 million gallons (2019) to 237.3 million gallons (2028) (see Figure 4).



Source: DIS historical and projected estimates based on MO DOR diesel data and EIA national diesel and biodiesel data.
*Scenario 2: 2006-2016: follow national trend share of U.S. biodiesel consumption to U.S. diesel consumption. Jan 2017-Mar 2023: 5%; 2023-2025: Apr-Oct 10%, Nov-Mar: 5%; 2025-2028: Apr-Oct: 20%, Nov-Mar: 5%
**2019: Jan-Oct: actual data, Nov-Dec projected, 2020-2028: Jan-Dec projected.

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Figure 4, Missouri Biodiesel Sale, Scenario 2 (B20)

Figure 5 shows the annual actual biodiesel consumption in each of the three consumption settings. For example, if B10 was implemented, the annual average of the biodiesel inclusion rate in the mix would be 7.9% instead of 10%since the biodiesel inclusion rate of 10% (B10) would be allowed only during seven months (April to October) of the year. The inclusion rate would drop to 5% (B5) during the remaining part of the year. In the case of B20, the average annual inclusion rate would be 13.8% instead of 20% during the period the policy would be in effect.

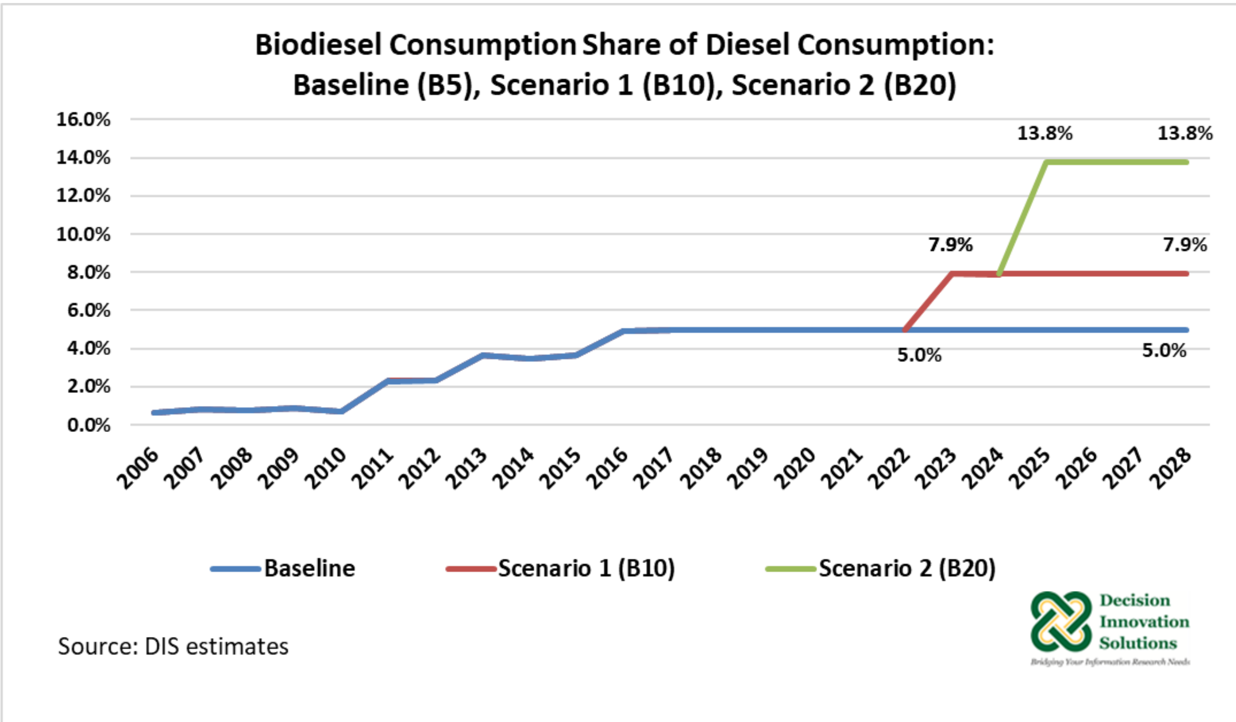


Figure 5, Biodiesel Consumption Share of Diesel Consumption: Baseline (B5), Scenario 1 (B10), Scenario 2 (B20)

Soybean Oil Usage by Biodiesel Sold (Consumed) in Missouri

SBO demand was estimated assuming all biodiesel consumed in Missouri was SBO based biodiesel (100% biodiesel fuel). A conversion factor of 7.55 pounds of soybean oil per gallon of biodiesel was used to estimate the volume (pounds) of SBO demanded through the consumption of highway and non-highway biodiesel. Estimates were based on the Baseline case and the two alternative consumption scenarios.

If only the B5 mix is consumed in Missouri, SBO demand would reach a volume of 6.1 billion pounds during the 2019 to 2028 period; however, if Scenario 1 (B10) were implemented instead, the demand for SBO would be up 36% to 8.3 billion pounds from the volume consumed in the Baseline case during the same period. Lastly, in the case of Scenario 2 where B20 would be consumed starting in April 2025, the total volume of SBO demanded would increase 85% to 11.3 billion pounds during 2019 to 2028 compared with the Baseline case. Figure 6, Figure 7, and Figure 8 show the historical and projected SBO demand under the three consumption settings.

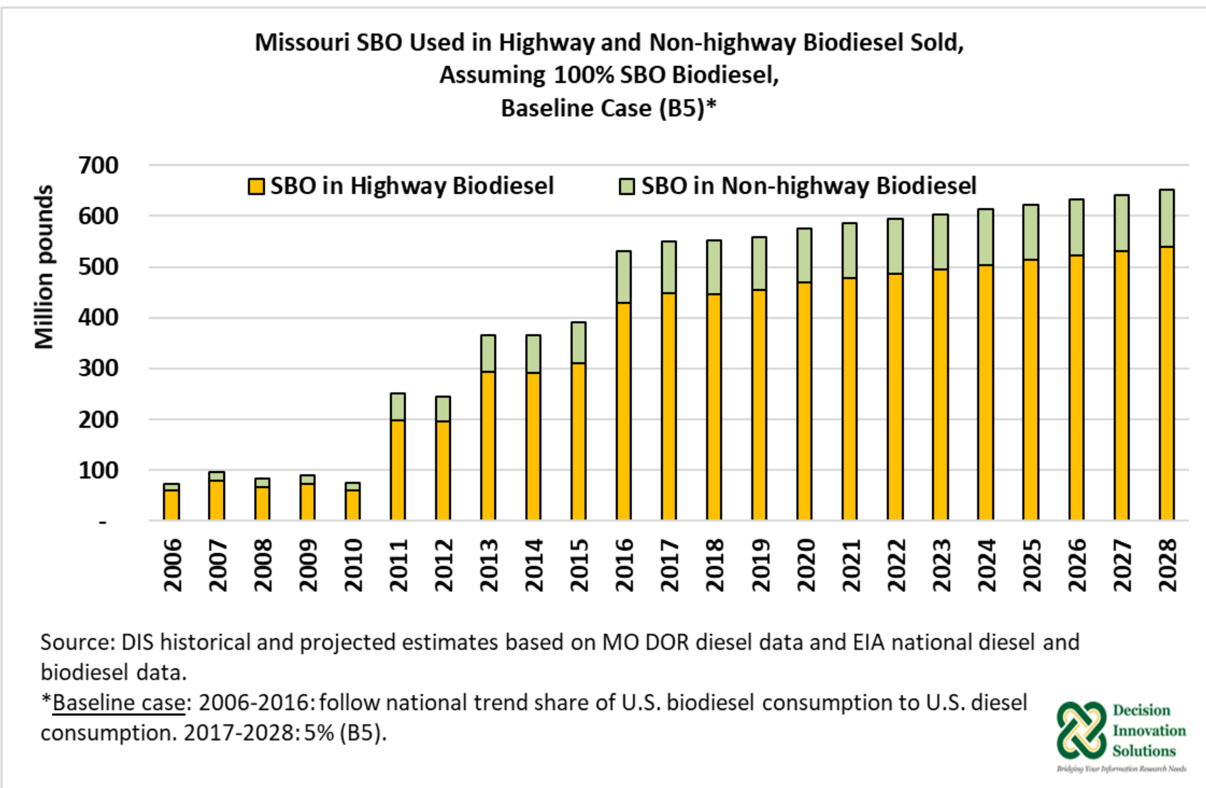
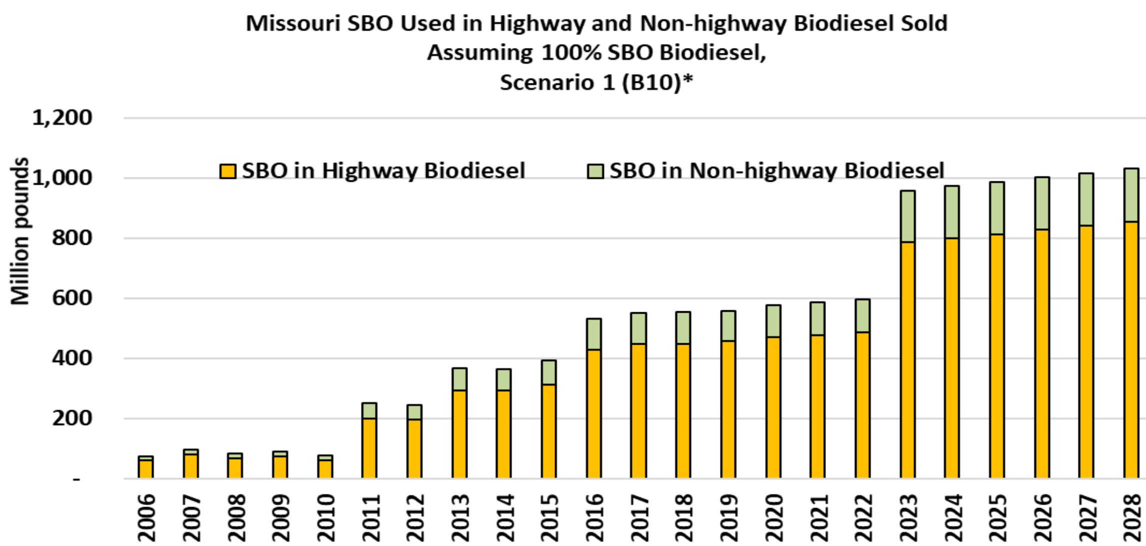


Figure 6, Missouri SBO Used in Highway and Non-highway Biodiesel Sold, Assuming 100% SBO Biodiesel, Baseline Case (B5)



Source: DIS historical and projected estimates based on MO DOR diesel data and EIA national diesel and biodiesel data.
*Scenario 1: 2006-2016: follow national trend share of U.S. biodiesel consumption to U.S. diesel consumption. Jan 2017-Mar 2023: 5% (B5). 2023-2028: Apr-Oct: 10% (B10), Nov -Mar: 5%
**2019: Jan-Oct: actual data, Nov-Dec projected, 2020-2028: Jan-Dec projected.

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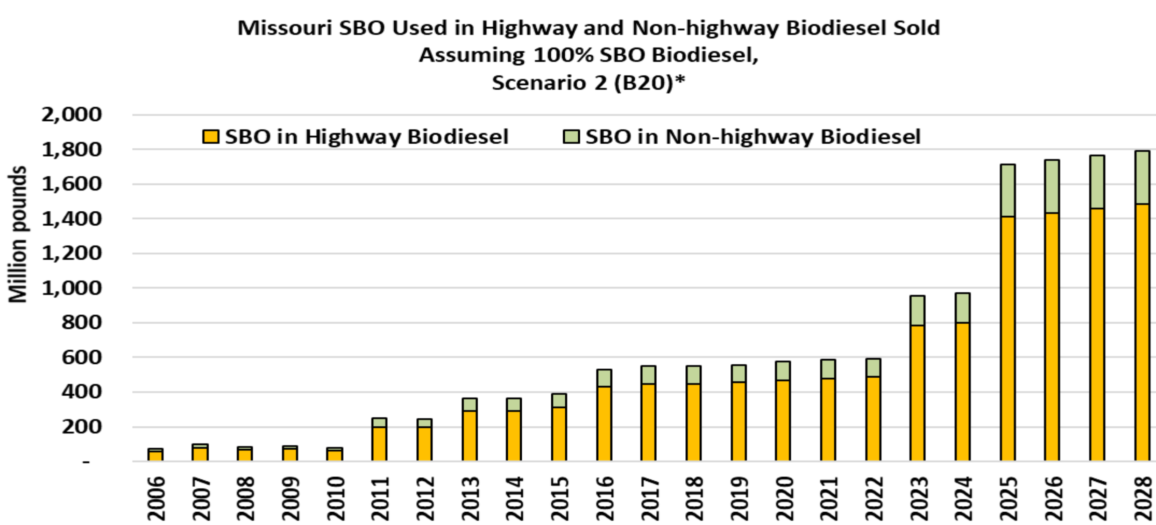
Figure 7, Missouri SBO Used in Highway and Non-highway Biodiesel Sold, Assuming 100% SBO Biodiesel, Scenario 1 (B10)



Source: DIS historical and projected estimates based on MO DOR diesel data and EIA national diesel and biodiesel data.
*Scenario 2: 2006-2016: follow national trend share of U.S. biodiesel consumption to U.S. diesel consumption. Jan 2017-Mar 2023: 5% (B5); 2023-2025: Apr-Oct 10% (B10), Oct-Mar: 5% (B5); 2025-2028: Apr-Oct: 20% (B20), Nov-Mar: 5% (B5).
**2019: Jan-Oct: actual data, Nov-Dec projected, 2020-2028: Jan-Dec projected.

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Figure 8, Missouri SBO Used in Highway and Non-highway Biodiesel Sold, Assuming 100% SBO Biodiesel, Scenario 2 (B20)

Soybean Oil Content in Missouri Soybeans

From 2006 to 2018, the average mean value of soybean oil content in Missouri soybeans was estimated at 19.1% (±0.46) with a trend (slope) factor equal to 0.072 per year. As noted in Figure 9, not much variation has occurred during the historical years. The historical data of Missouri SBO content was from the U.S. Soybean Quality Reports published by the University of Minnesota. The historical mean SBO content value (19.1%) was used during the projected period starting in 2019.

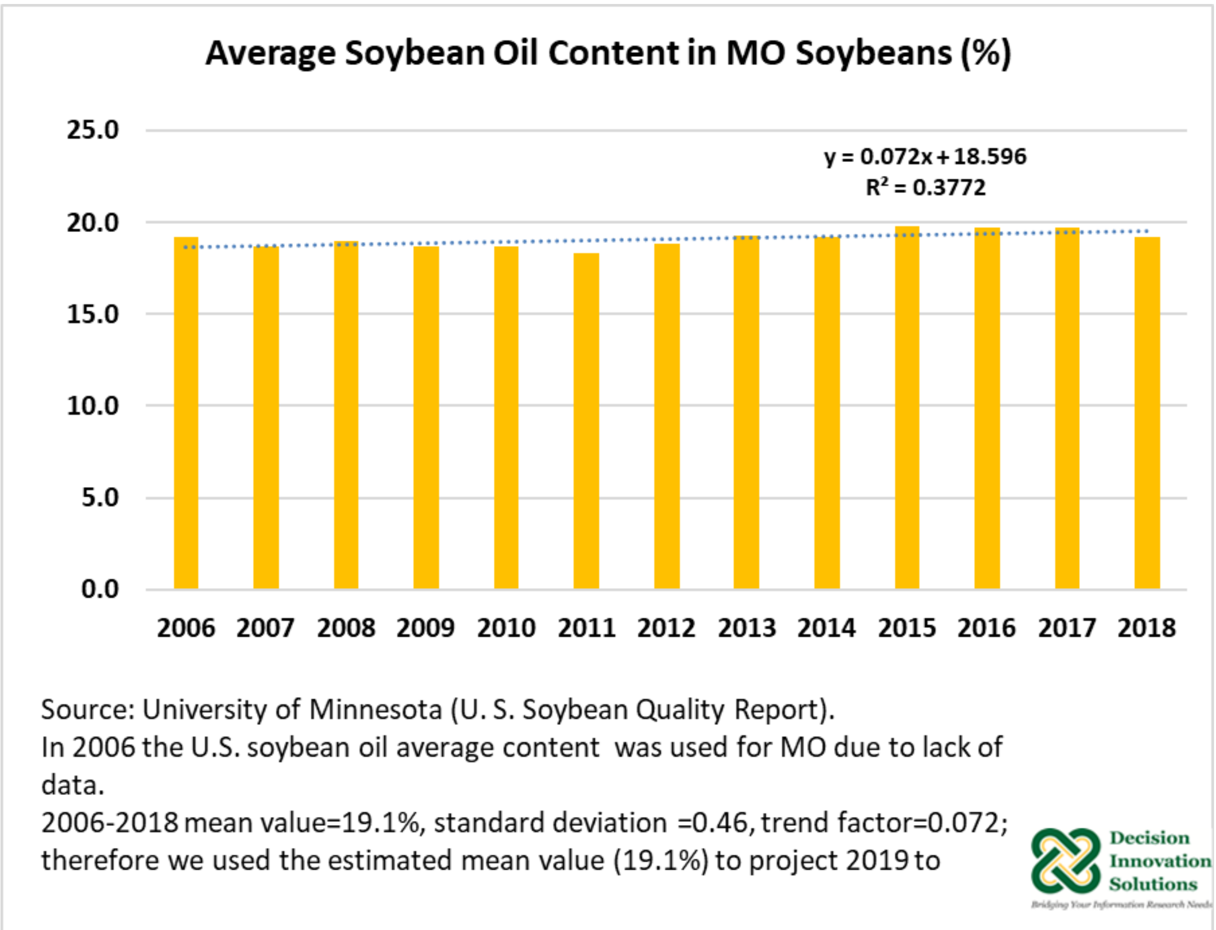


Figure 9. Average Soybean Oil Content in MO Soybeans (%)

Soybean Usage/Crush by Biodiesel Consumed in Missouri

The soybean oil content of Missouri soybeans was factored into determining the soybean demand based on the Baseline case, Scenario 1, and Scenario 2. The historical (2006 to 2018) SBO content of Missouri soybeans was sourced from the U.S. Soybean Quality Reports from the University of Minnesota. Due to the lack of data for Missouri soybean oil content in 2006 the average U.S. SBO content of soybeans (19.2%) was used.

The volume (pounds) of SBO rendered per bushel of soybeans was estimated as:

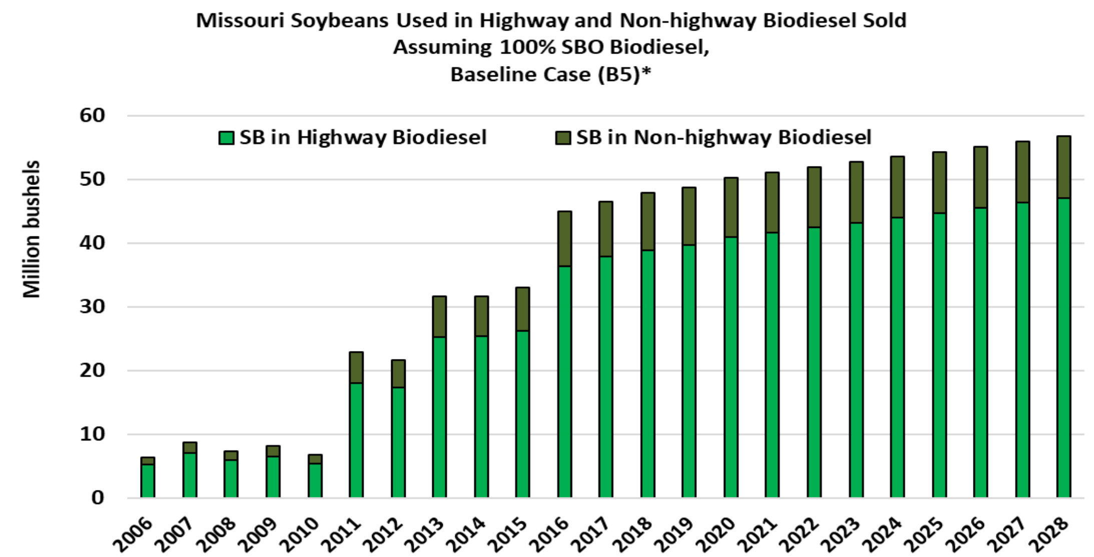
SBO content of Missouri soybeans X 60 pounds.

The volume (bushels) of soybeans used in biodiesel sold was estimated as:

SBO used in biodiesel sold/SBO rendered

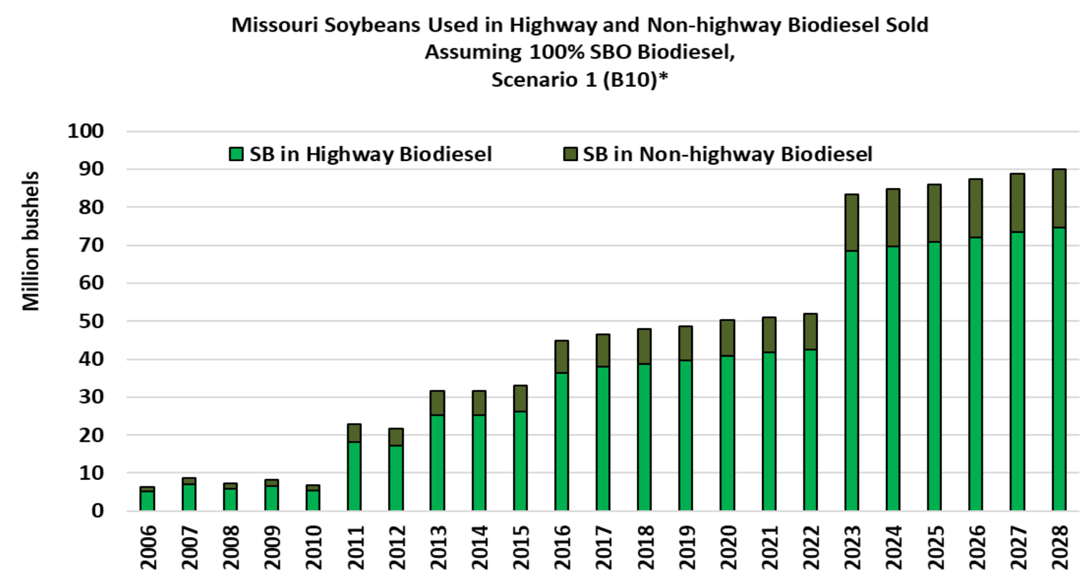
The volumes of soybean usage/crush for highway and non-highway biodiesel consumed in B5, B10, and B20 were estimated. Results indicate that if only the B5 (Baseline case) mix was consumed in Missouri, soybean demand would total 530.6 million bushels during the 2019 to 2028 period. This represents 21% of the total volume of Missouri projected soybean production (2.6 billion bushels) during the same 10-year period. In contrast, if B10 (Scenario 1) was approved instead, the demand for soybeans would be 722.4 million bushels (28% of total Missouri soybean projected production). Finally, in the case of B20 (Scenario 2) which would be consumed starting in April 2025, the total volume of soybeans demanded would result in 1.1 billion bushels during 2019 to 2028 (43% of projected Missouri soybean production). Figure 10, Figure 11, and Figure 12 show the historical and projected soybean demand under the three levels of consumption.

Figure 13 presents Missouri projected soybean production during 2019 to 2028 and the corresponding soybean demands by B5, B10, and B20 consumption. Over the 2019 to 2028 period, implementation of a B20 biodiesel standard would result in 43% of the soybeans of Missouri being used to satisfy the biodiesel demand within Missouri.



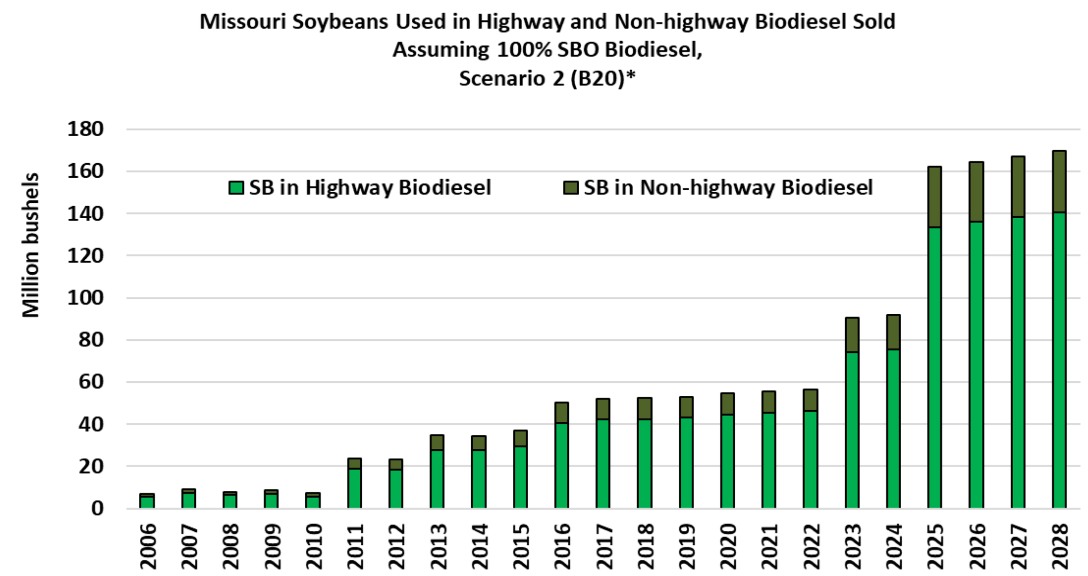
Source: DIS historical and projected estimates based on MO DOR diesel data and EIA national diesel and biodiesel data.
*Baseline case: 2006-2016: follow national trend share of U.S. biodiesel consumption to U.S. diesel consumption. 2017-2028: 5% (B5).
**2019: Jan-Oct: actual data, Nov-Dec projected, 2020-2028: Jan-Dec projected

Figure 10, Missouri Soybeans Used in Highway and Non-highway Biodiesel Sold, Assuming 100% SBO Biodiesel, Baseline Case (B5)



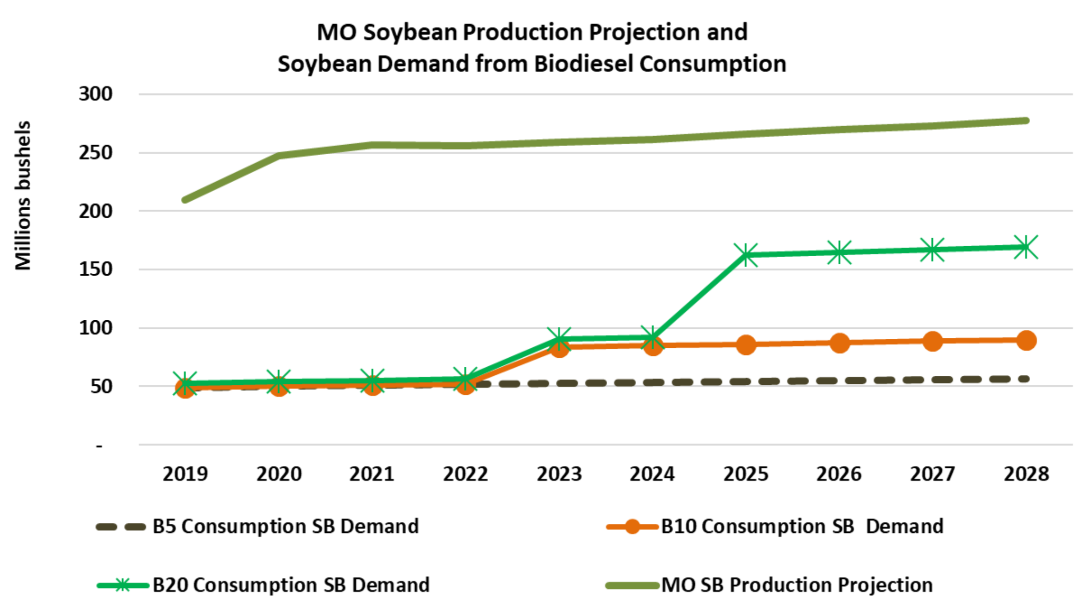
Source: DIS historical and projected estimates based on MO DOR diesel data and EIA national diesel and biodiesel data.
*Scenario 1: 2006-2016: follow national trend share of U.S. biodiesel consumption to U.S. diesel consumption. Jan 2017-Mar 2023: 5% (B5). 2023-2028: Apr-Oct: 10% (B10), Nov-Mar: 5% (B5)
**2019: Jan-Oct: actual data, Nov-Dec projected, 2020-2028: Jan-Dec projected.

Figure 11, Missouri Soybeans Used in Highway and Non-highway Biodiesel Sold, Assuming 100% SBO Biodiesel, Scenario 1 (B10)



Source: DIS historical and projected estimates based on MO DOR diesel data and EIA national diesel and biodiesel data.
*Scenario 2: 2006-2016: follow national trend share of U.S. biodiesel consumption to U.S. diesel consumption. Jan 2017-Mar 2023: 5% (B5); 2023-2025: Apr-Oct 10% (B10), Nov-Mar: 5% (B5); 2026-2028: Apr-Oct: 20% (B20), Nov-Mar: 5% (B5).
**2019: Jan-Oct: actual data, Nov-Dec projected, 2020-2028: Jan-Dec projected.

Figure 12, Missouri Soybeans Used in Highway and Non-highway Biodiesel Sold, Assuming 100% SBO Biodiesel, Scenario 2 (B20)



Source: DIS estimates. MO soybean production projections follow the national soybean production projection based on USDA long term projections to 2029.

Figure 13, MO Soybean Production Projection and Soybean Demand from Biodiesel Consumption

Missouri Biodiesel Model

Although Missouri currently has seven full-time biodiesel production facilities, one of these facilities produces biodiesel primarily from non-soybean oil sources (mainly animal fats and oils). For the purposes of this analysis, only biodiesel produced from soybean oil is modeled, thus the Missouri Biodiesel Production Model includes only Missouri's six currently operating soy-based biodiesel plants. These have a current plant capacity of 213.0 million gallons/year and are estimated to have produced 170 million gallons of biodiesel in 2019. Unused biodiesel production capacity from plants in nearby states is not considered in the Missouri Biodiesel Production Model analysis.

From 2020 to 2028, Missouri baseline production is forecast to grow at a rate of 1.066, which is the projected diesel consumption annual average growth rate from 2019-2028. The Missouri baseline production would increase from 170 million gallons/year in 2019 to 197 million gallons/year in 2028.

Baseline Case (B5)

In the Baseline case (B5) of the Missouri biodiesel model, Missouri biodiesel consumption would increase 17% during the projected period. Biodiesel consumption from 2019 (74 million gallons) to 2028 (86 million gallons) would average 44% of Missouri baseline production, thus, baseline production would remain below plant capacity during the 10-year projected period. Since biodiesel domestic demand is expected to remain below baseline production capacity in this case, out of state shipments can continue and are estimated to increase 15%, from 96 million gallons in 2019 to 111 million gallons in 2028. Since total demand for biodiesel from Missouri biodiesel production facilities is below current capacity of 213 million gallons per year, there is no pressure to reduce or "scalp" demand from out-of-state shipments in order to meet in-state demand. Thus the Scalping and No-scalping case results are the same because Baseline production never goes beyond production capacity (see Figure 14 and Figure 15). Under the baseline case, biodiesel production reaches 93% of Missouri soy-based biodiesel production capacity.

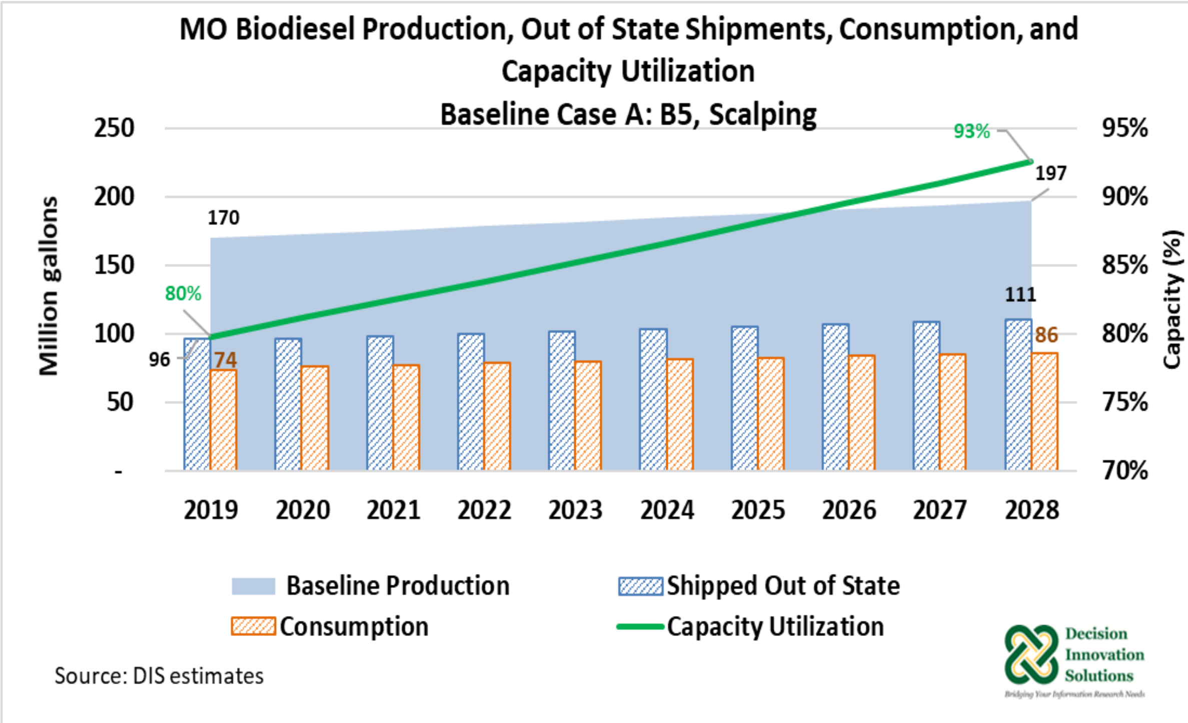


Figure 14, MO Biodiesel Production, Out of State Shipments, Consumption, and Capacity Utilization, Baseline Case A: B5, Scalping

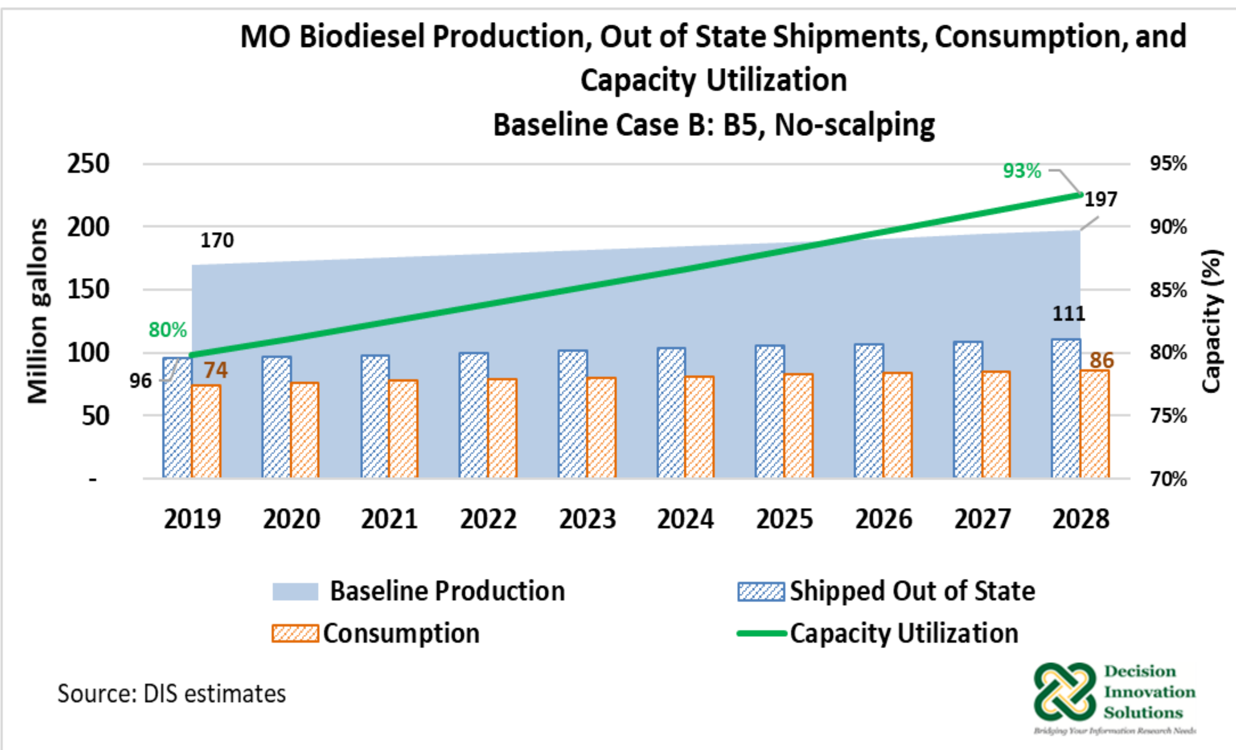


Figure 15, MO Biodiesel Production, Out of State Shipments, Consumption, and Capacity Utilization, Baseline Case B: B5, No-scalping

Scenario 1 (B10)

Scenario 1 (B10) of the Missouri biodiesel production model indicates production above baseline will start to grow in 2022 due to the B10 policy implementation which would begin in April 2023. Production above baseline would grow from 7.8 million in 2022 to 50.5 million gallons in 2028. Under this scenario, from 2019 to 2028 Missouri biodiesel consumption would increase 85%. In the scalping case, by 2023 total production (baseline + above baseline) would surpass plant capacity, but because of the limitation imposed in this case, total production would top out at current plant capacity (213 million gallons); therefore, out-of-state shipments would start to decline. By 2028, out-of-state shipments would fall 21% compared with 2019 out-of-state shipment levels. (see Figure 16). In the no-scalping case, both Missouri biodiesel demand and out-of-state shipments increase (see Figure 17), and total production exceeds plant capacity, from 107% in 2023 to 116% in 2028 (see Figure 18). This reflects an annual new capacity needed of 35.2 million gallons by 2028. While this might suggest the need for expanded biodiesel production capacity within Missouri, the reality is that there is unused capacity in nearby locations that would be more than enough to meet the “over-capacity” production needs identified through the Missouri Biodiesel Production model.

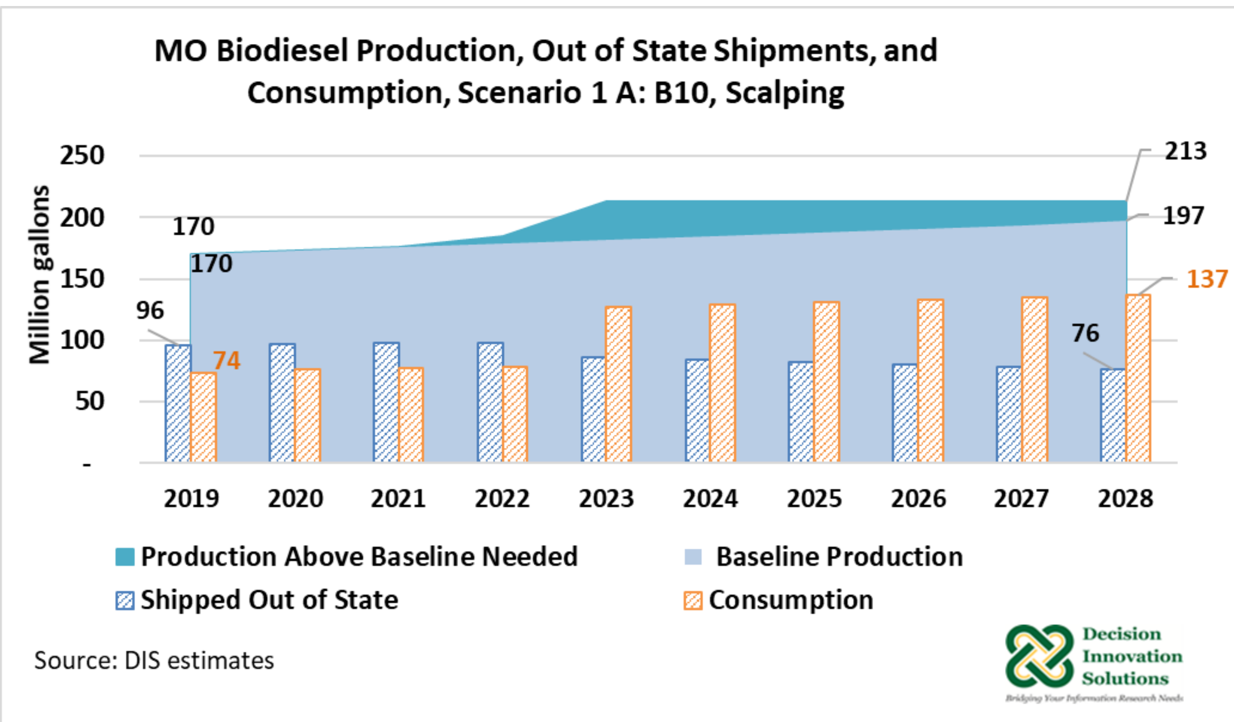


Figure 16, MO Biodiesel Production, Out of State Shipments, and Consumption, Scenario 1 A: B10, Scalping

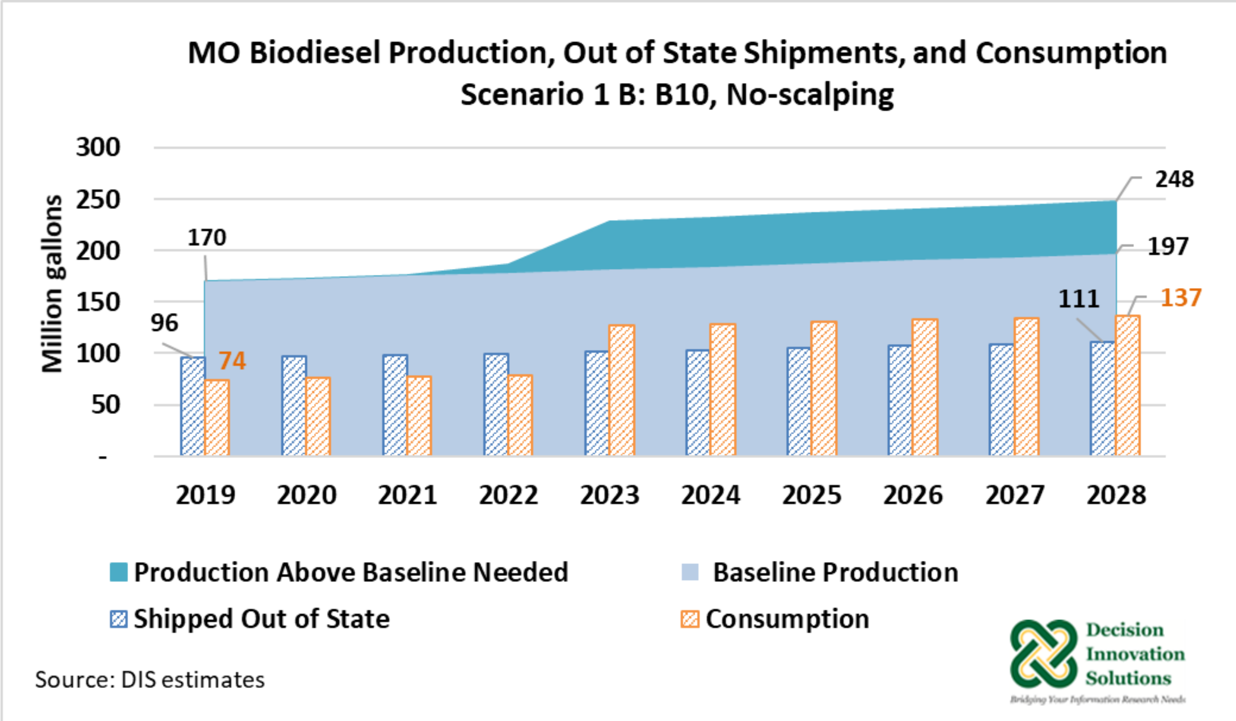


Figure 17, MO Biodiesel Production, Out of State Shipments, and Consumption Scenario 1 B: B10, No-scalping

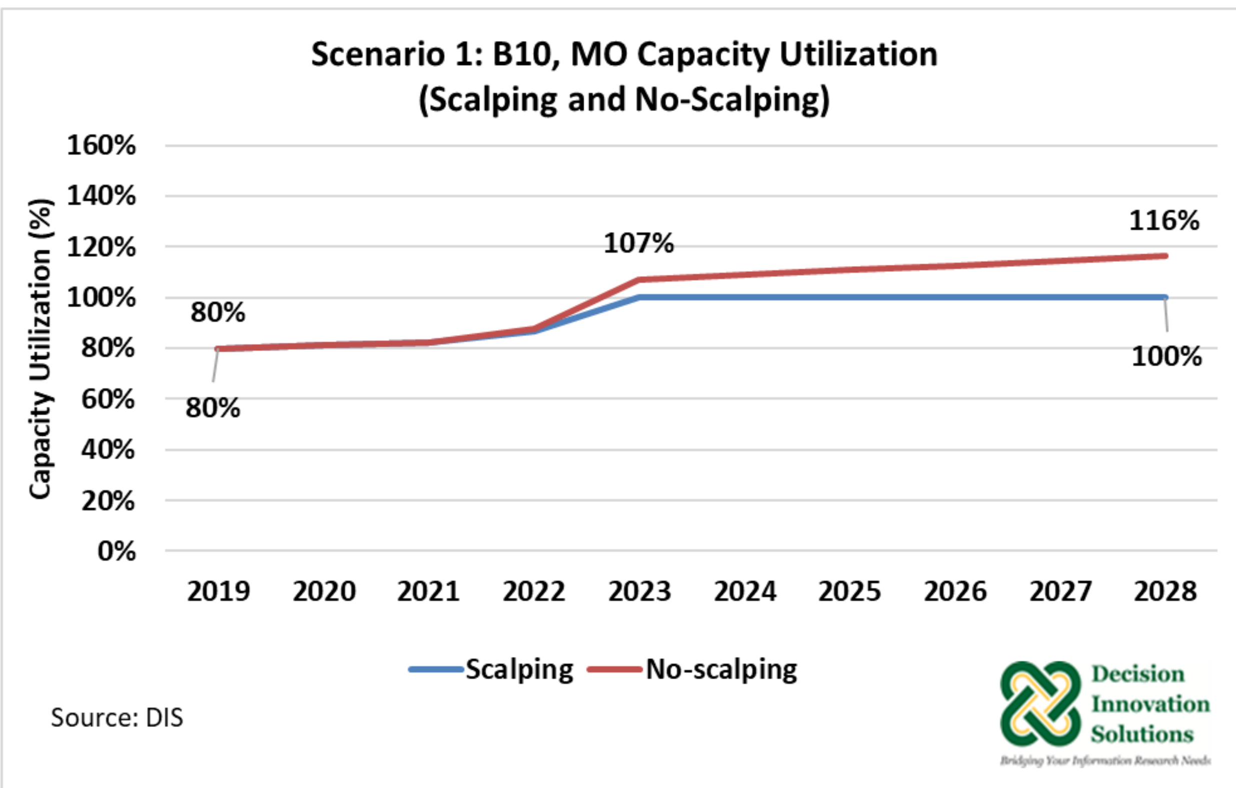


Figure 18, Scenario 1: B10, MO Capacity Utilization (Scalping and No-Scalping)

Scenario 2 (B20)

Under scenario 2 (B20), Missouri biodiesel demand would expand 221% from 2019 to 2028. Similarly to the Scenario 1 (B10) scalping case, in Scenario 2 (B20) scalping case, total Missouri-based biodiesel production is capped at 213 million gallons, which is the total capacity installed, but because Missouri biodiesel demand increases even more under Scenario 2 (B20) due to implementation of the B20 mix starting in April 2025, out-of-state shipments would not only decline but completely disappear by the end of the projected period (see Figure 19). In the no-scalping case, domestic demand and out of state shipments would require a total production (baseline production+ above baseline production) of 349 million gallons by 2028 (see Figure 20), which implies a capacity utilization of 164% (see Figure 21) and annual additional capacity needed of 137 million gallons by 2028.

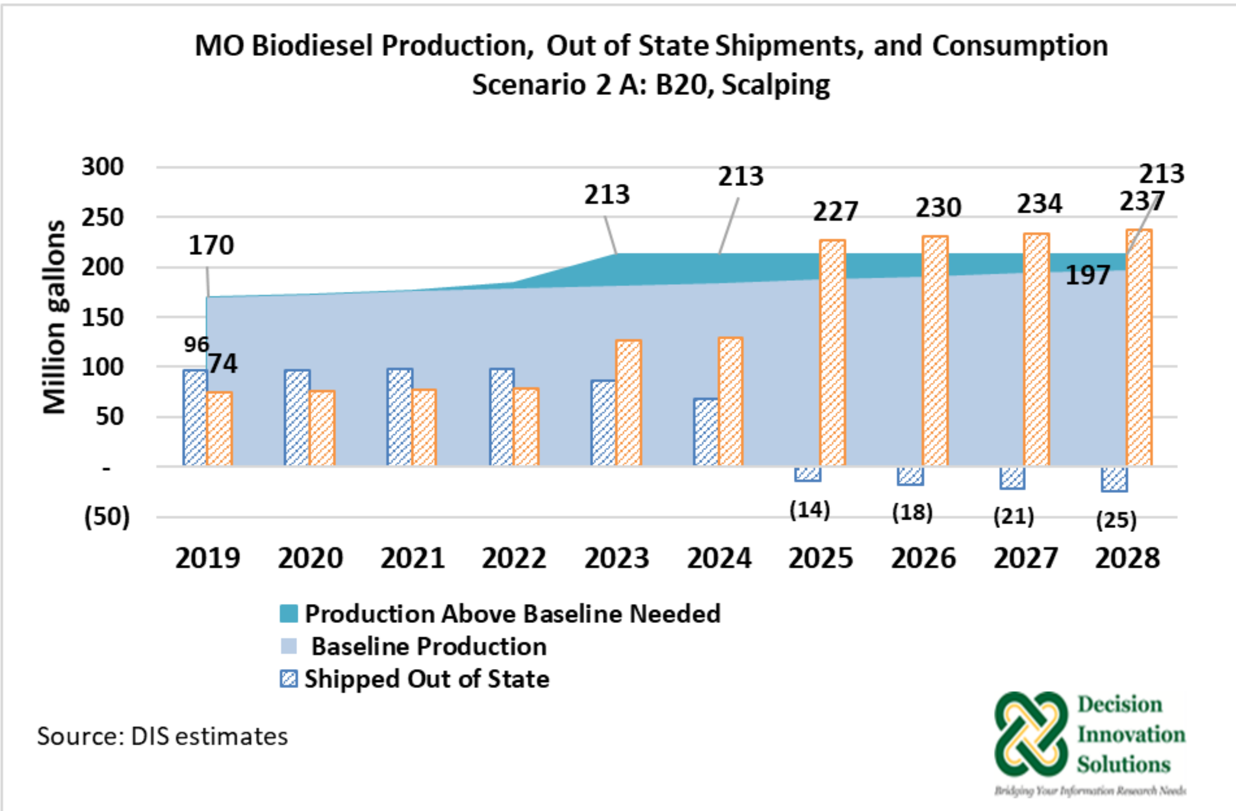


Figure 19, MO Biodiesel Production, Out of State Shipments, and Consumption, Scenario 2 A: B20, Scalping

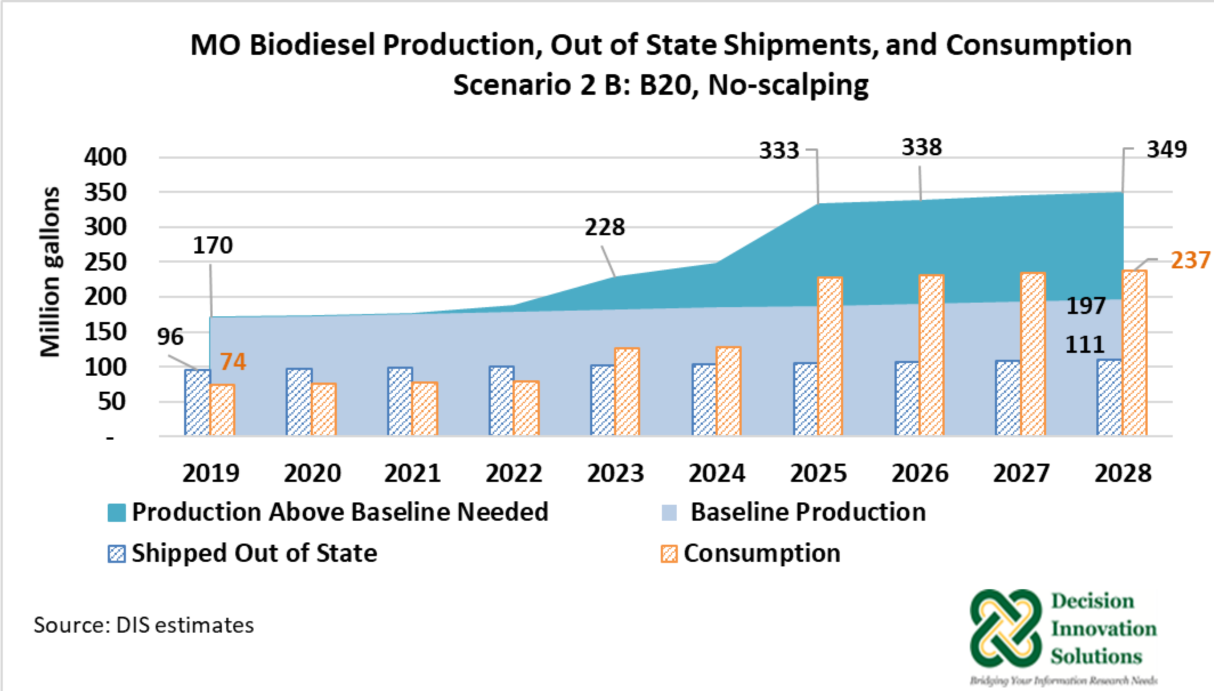


Figure 20, MO Biodiesel Production, Out of State Shipments, and Consumption Scenario 2 B: B20, No-scalping

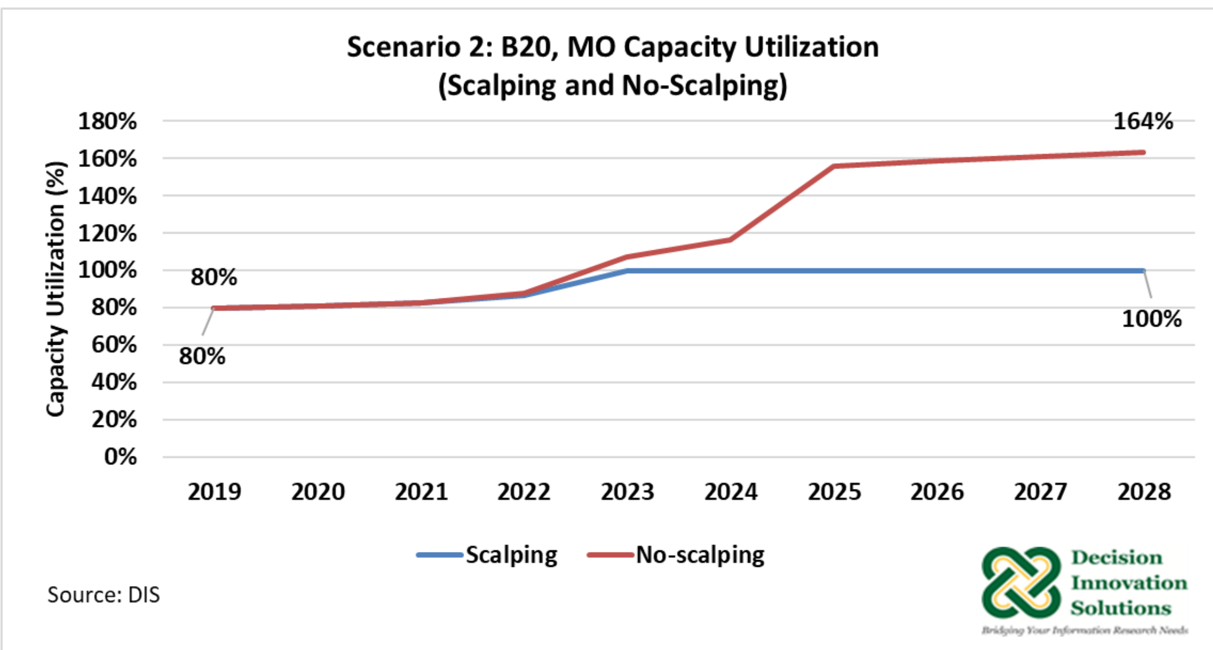


Figure 21, Scenario 2: B20, MO Capacity Utilization (Scalping and No-Scalping)

Note that in both scenario 1 (B10) and scenario 2 (B20) no-scalping cases, there is a need to increase capacity in order to keep both the domestic demand and out-of-state shipments, but before building a new plant, unused biodiesel capacity from nearby states should be considered. This consideration is included in the following Regional and Neighbor state biodiesel models.

Regional Biodiesel Model

In the Regional model, the total baseline capacity is the sum of Missouri baseline capacity and the estimated unused existing capacity (at the beginning of 2019) from the selected states and regions. For the Regional Biodiesel Model, biodiesel plants and soybean oil supplies located in the USDA Crop Reporting Districts (CRDs) that abut Missouri from Illinois, Iowa, Nebraska, Kansas, Oklahoma, Arkansas, Tennessee, and Kentucky are considered along with Missouri-based facilities.

In January 2019, the combined unused existing capacity from these selected states and regions was equal to 52.1 million gallons per year (see Table 15). The analysis assumed that these biodiesel plants are operating at the national average biodiesel plant capacity utilization rate of 74%. It was also assumed that unused plant capacity declines at a 0.0833% rate each month (1% annual rate compounded monthly) starting in February 2019 due to increased biodiesel consumption in areas outside of Missouri and not directly affected by the Missouri policy initiative. The 2019 baseline combined capacity (Missouri capacity + unused Regional capacity) was equal to 265 million gallons/year (213 million gallons/ year + 52 million gallons/year), in contrast in 2028 the combined baseline capacity declines to 260 million gallons /year (213 million gallons/ year + 47 million gallons/year) (see Figure 22).

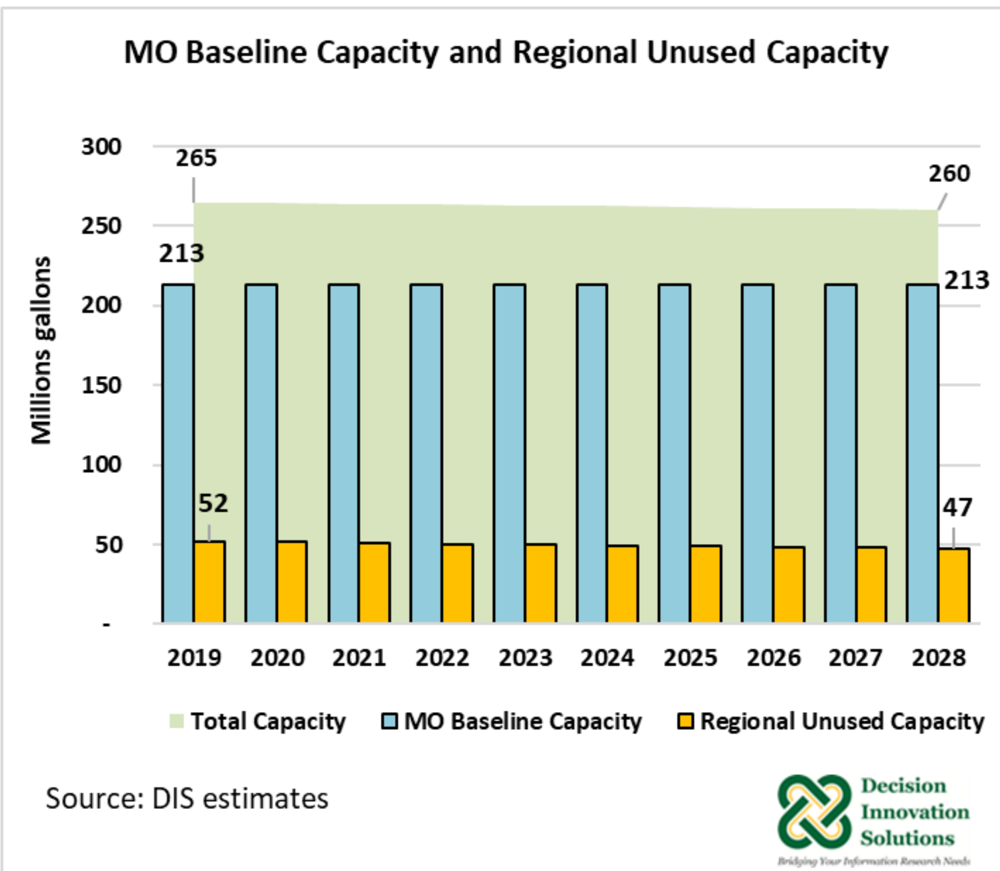


Figure 22 MO Baseline Biodiesel Production Capacity and Regional Unused Capacity

Baseline Case (B5)

Results of the Baseline case (B5) of the Regional biodiesel model are the same as the Baseline case (B5) of the Missouri biodiesel model except that by 2028 regional capacity utilization rises from 64% in 2019 to 76% by 2028 (see Figure 23).

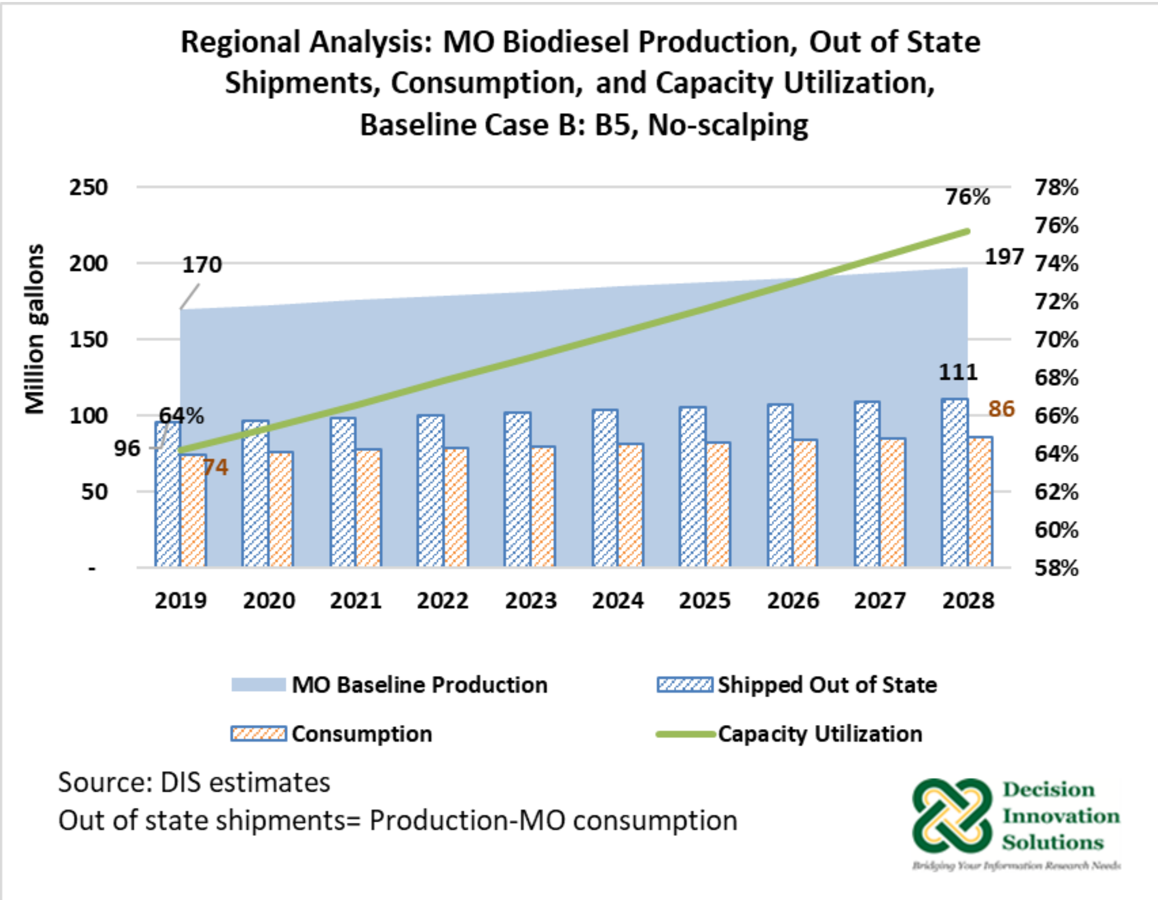


Figure 23, Regional Analysis: MO Biodiesel Production, Out of State Shipments, Consumption, and Capacity Utilization, Baseline Case B: B5, No-scalping

Scenario 1 (B10)

Scenario 1 (B10) of the Regional biodiesel model indicates production above baseline would start to grow in 2022 as the B10 policy would be in effect in April 2023. Production above baseline would grow from 7.8 million in 2022 to 50.5 million gallon in 2028. Under this scenario of the Regional biodiesel model, from 2019 to 2028 biodiesel consumption would increase 85%. Note that both production above the baseline and consumption remain the same as in the Missouri biodiesel model. However, because of the expanded capacity in the Regional model, total production does not surpass capacity in either the scalping case or the no-scalping case, and thus out-of-state shipments can increase in both cases from 96 million gallons at the beginning of the projected period to 111 million gallons by end of the projection. By 2028, regional capacity utilization would reach a rate of 95% (See Figure 25). This indicates that in the

Regional model case of Scenario 1 (B10), total production would reach a volume of 248 million gallons by 2028, which is less than the Missouri plus Regional capacity available in this case. By 2028 the actual in-state biodiesel demand (137 million gallons) and biodiesel out-of-state shipments (111 million gallons) combined would be 5% below the total regional production capacity. Since both the scalping and no-scalping cases would be the same under the B10 policy of the Regional model, only the No-scalping case is shown below.

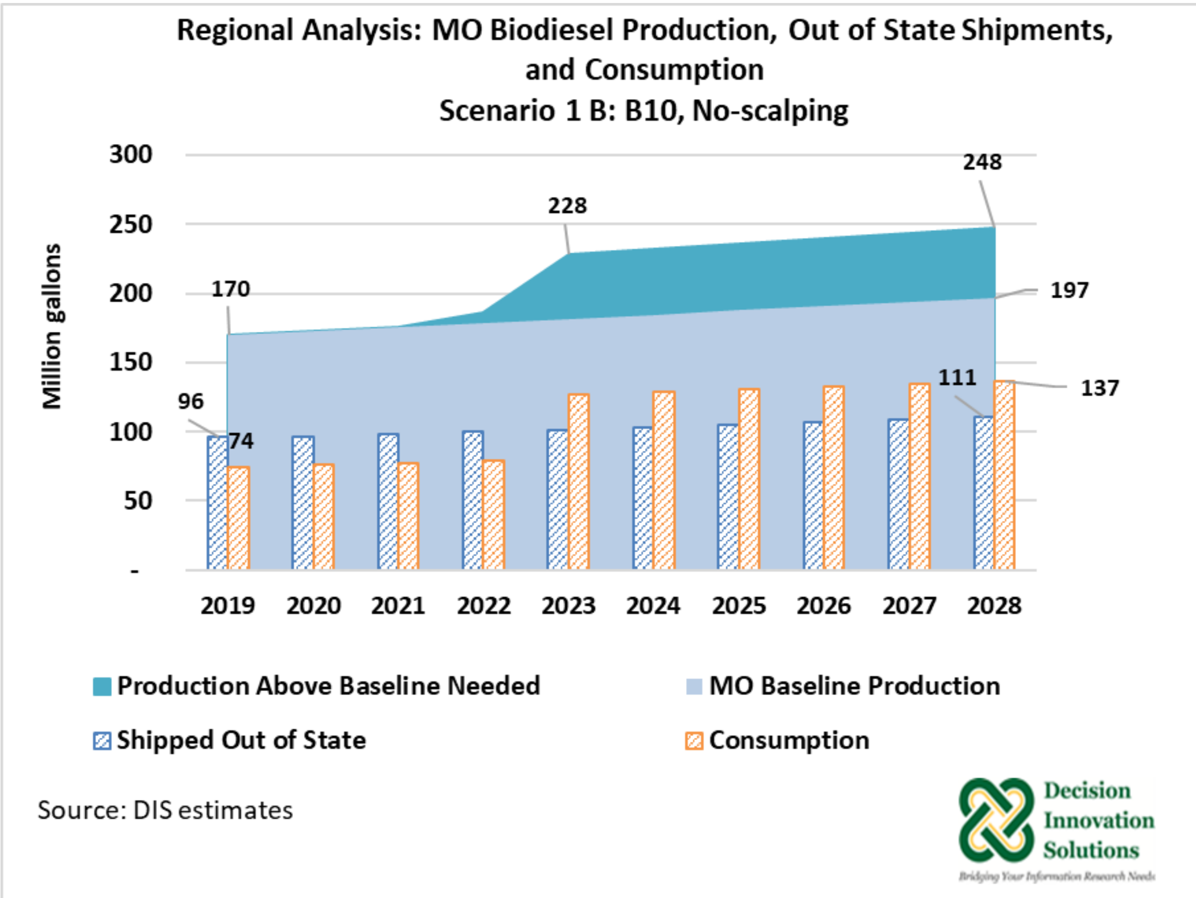


Figure 24, Regional Analysis: MO Biodiesel Production, Out-of-State Shipments, and Consumption, Scenario 1B: B10, No-scalping

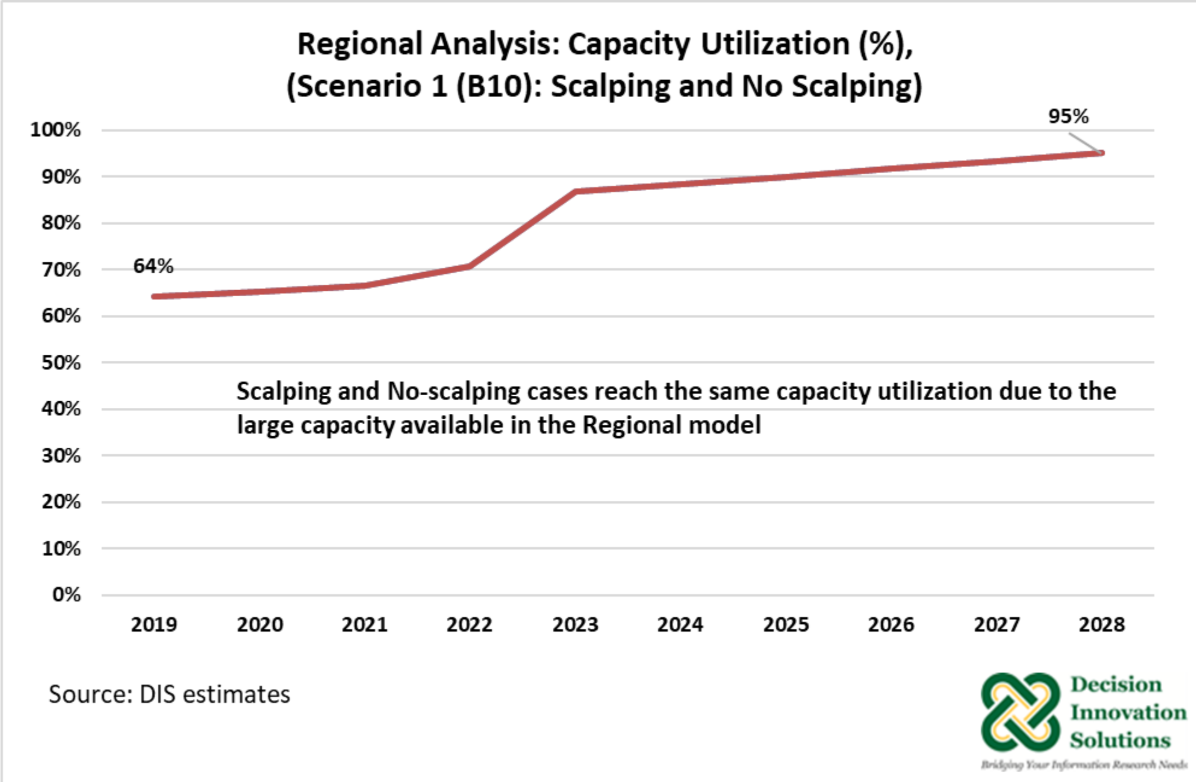


Figure 25, Regional Analysis: Capacity Utilization (%), (Scenario 1 (B10): Scalping and No Scalping)

Scenario 1 Conclusions

Under Scenario 1, in which a B10 blend of biodiesel is used for 7 months of the year, in-state biodiesel consumption rises from 74 million gallons in 2019 to 137 million gallons in 2028. Out-of-state shipments rise from 96 million gallons in 2019 to 111 million gallons in 2028. This requires 248 million gallons of soy-based biodiesel to be produced to satisfy in-state consumption and to maintain out-of-state shipments. Missouri has 213 million gallons of current soy-based biodiesel production capacity. If all of this were to be produced within Missouri, all existing plants would need to produce at capacity and an additional 35 million gallons per year of new capacity would be required. However, when regional biodiesel production capacity is taken into account, all of the 248 million gallons per year would be able to be produced by existing biodiesel production plants (Figure 24). Total regional capacity utilization would reach 95% by the end of 2028 (Figure 25).

Even though biodiesel production capacity within the region is sufficient to meet the Scenario 1 biodiesel demand needs, the total amount of soybean oil used in biodiesel production within the region to meet the Missouri in-state use and maintain out-of-state shipments increases from 1,283.5 million pounds in 2019 to 1,868.6 million pounds in 2028. Currently, there is enough soybean crush capacity in the region to product 4,752 million pounds of soybean oil. While the marketing pattern for all of the soybean oil produced in the region is not addressed in this study, production within the region is sufficient to cover the additional soybean oil demand of the Missouri policy initiatives although some changes in existing soybean oil marketing patterns would likely have to occur. If additional soybean oil production were determined to be needed or desired, by 2028 it would take 51 million bushels of increased crush capacity to produce the 586 million pounds of soybean oil to make the additional biodiesel.

Scenario 1: Soybean Production & Processing Impacts

Soybean production in Missouri is expected to increase from 247.6 million bushels in 2020 to 277.3 million bushels by 2028 using national trendline production increases. Thus, 30 million of the 51 million additional bushels needed for Scenario 1 biodiesel consumption are likely to come from natural increases. Implementation of Scenario 1 could stimulate about 20 million bushels of new (above trendline) soybean production within Missouri if the additional processing of the soybeans and the soybean oil production were conducted in Missouri.

On a regional basis, it is anticipated that soybean production will increase by 100 million bushels from 2020 to 2028. Thus, on a regional basis, there would be enough soybeans from trendline production to supply the soybean oil needed for Scenario 1. With 100 million bushels of additional soybean production coming from trendline production increases within the region by 2028, it is likely that some additional soybean processing capacity may be needed to meet increasing livestock demand for protein meals and for increasing domestic biodiesel usage of soybean oil. This analysis suggests that with increased soybean oil demand for biodiesel use in Missouri due to Scenario 1, there could be enough demand to support expansion of existing soybean processing capacity by at least 30 million bushels per year and the potential for construction of a new soybean processing plant with at least 50 million bushels of capacity.

Scenario 2 (B20)

Scenario 2 (B20) of the Regional biodiesel model indicates production above baseline would start to grow in 2022 due to the B10 policy implementation which would begin in April 2023 and later due to the B20 application in April 2025. Production above baseline would grow from 7.8 million gallons in 2022 to 151 million gallons in 2028. Under this scenario biodiesel consumption in Missouri would increase 221% from 74 million gallons in 2019 to 237 million gallons in 2028. Both production above the baseline and the level of consumption remain the same as in Scenario 2 of the Missouri model because these two variables depends on the level of consumption determined by the policy in place, which in this case would be the B20 policy. In the scalping case, total production (baseline+ above baseline) would surpass plant capacity by 2025, but due to the limitation imposed in this case (scalping), total production would remain at plant capacity available each year. In the Regional model, available capacity drops every year due to the assumption that unused capacity from the selected plants in the regional states declines at an annual percent rate of 1% (0.083% each month) starting in February 2019. By 2028, available capacity would be at 260 million gallons/year and production would be capped at that volume; therefore, out of state shipments would start to decline. By 2028, out of state shipments would fall to 23 million gallons compared with 96 million gallons, the out of shipment volume in 2019 (see Figure 26). In the no-scalping case of the regional analysis, both Missouri biodiesel demand and out of state shipments increase (see Figure 27), and total production exceeds capacity, from 127% in 2025 to 134% in 2028 (see Figure 28). The new capacity needed by 2028 is estimated at 90 million gallons (see Figure 28). The Regional model analysis indicates that under Scenario 2B no-scalping case (Scenario 2B: B20, No-scalping), total capacity (Missouri + regional) is depleted and in order to continue supplying Missouri biodiesel demand while keeping the out of state shipments rolling, a new plant would be required. Building a plant with a 50 million gallon production capacity would supply 55% of the new capacity needed.

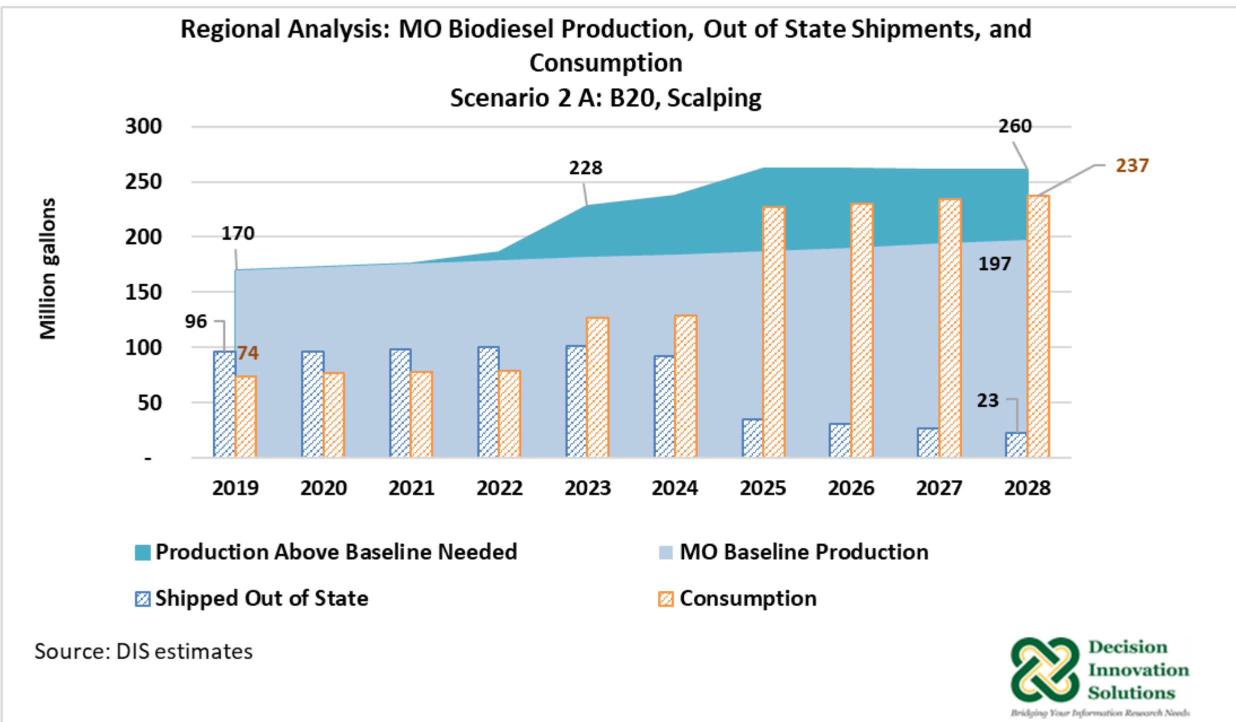


Figure 26, Regional Analysis: MO Biodiesel Production, Out of State Shipments, and Consumption, Scenario 2 A: B20, Scalping

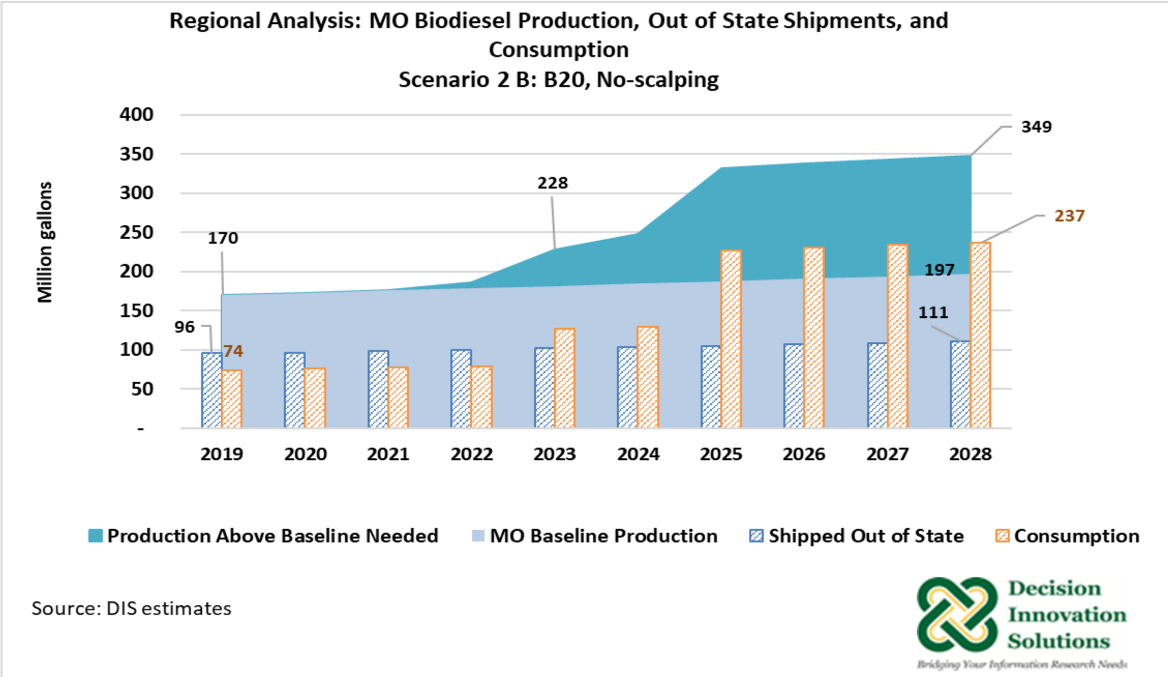


Figure 27, Regional Analysis: MO Biodiesel Production, Out of State Shipments, and Consumption, Scenario 2 B: B20, No-scalping

Figure 28 shows the capacity utilization of the regional soy-based biodiesel plants and the timing and quantity of new capacity that would be needed if current out-of-state shipments from Missouri biodiesel plants are to be maintained as Missouri implements a policy initiative to increase biodiesel consumption to B20 blends for 7 months per year beginning in 2024.

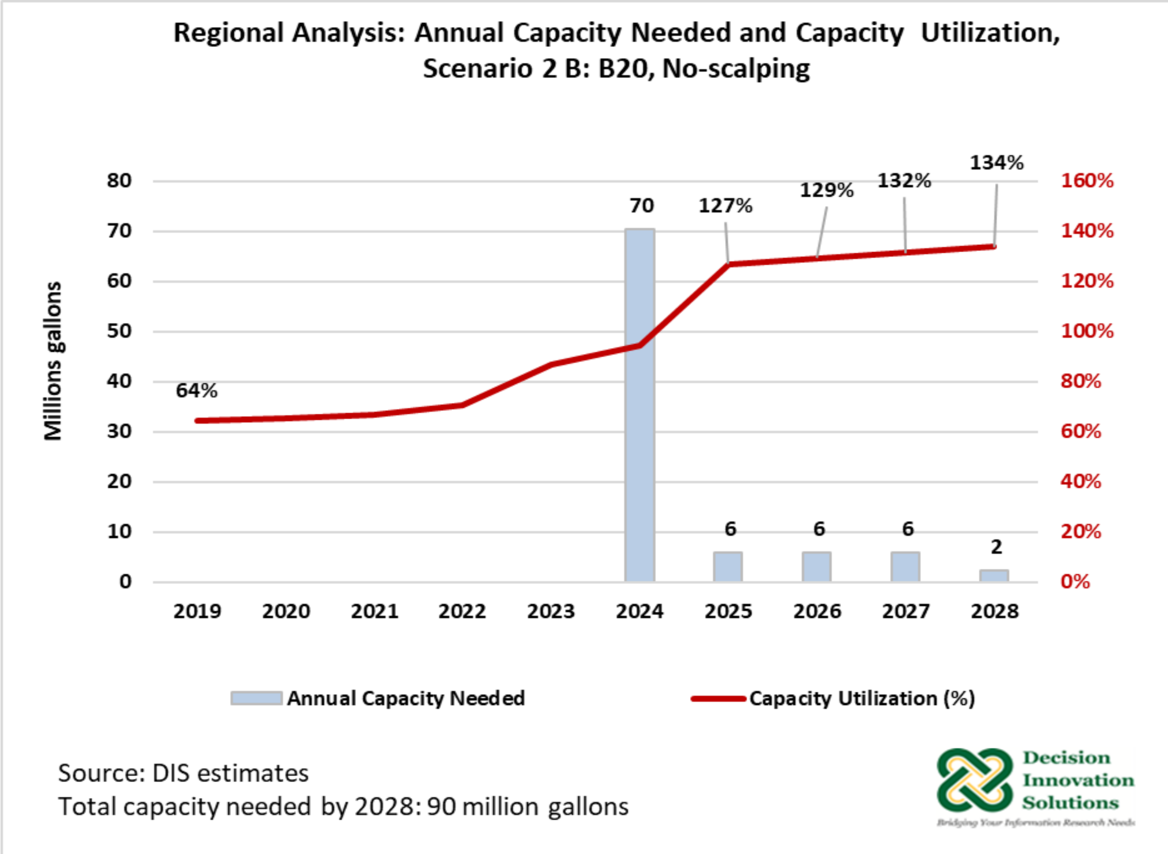


Figure 28, Regional Analysis: Capacity Utilization (%), (Scenario 2 (B20): Scalping and No Scalping

Scenario 2 Conclusions

Under Scenario 2B (B20 with no scalping), total soy-based biodiesel production for Missouri consumption (237 million gallons) and out-of-state shipments (111 million gallons) within the region would rise to 349 million gallons by 2028 (Figure 27). While the total soy-based biodiesel production capacity within the region is 413.5 million gallons, for this analysis, currently there is only 265 million gallons of capacity available to supply in-state Missouri consumption and to maintain current out-of-state shipments from Missouri biodiesel plants. Thus, under scenario 2B, there would be a shortfall in biodiesel production within the regional area of 70 million gallons in 2024 (see Figure 28) which is projected to rise to a production deficit of 90 million gallons by 2028.

Scenario 2A: Soybean Oil Impacts

Under Scenario 2A, the demand for soybean oil for biodiesel production to meet the Missouri in-state demand and ship any leftover biodiesel production to out-of-state shipments rises from 1,283 million pounds in 2019 to 1,963 million pounds by 2028. Under Scenario 2A, expansion of biodiesel production in the region is limited to current capacity of 260 million gallons and out-of-state shipments are allowed to decline as in-state consumption increases. Currently, there is enough soybean crush capacity in the region to produce 4,752 million pounds of soybean oil.

While the marketing pattern for all of the soybean oil produced in the region is not addressed in this study, production within the region is sufficient to cover the additional soybean oil demand of the Missouri policy initiatives although some changes in existing soybean oil marketing patterns would likely have to occur. If additional soybean oil production were determined to be needed or desired, by 2028 it would take 59 million bushels of increased crush capacity to produce the 679.5 million pounds of soybean oil to make the additional biodiesel.

Scenario 2A: Soybean Production & Processing Impacts

Soybean production in Missouri is expected to increase from 247.6 million bushels in 2020 to 277.3 million bushels by 2028 using national trendline production increases. Thus, 30 million of the 59 million additional bushels needed for Scenario 2A biodiesel consumption are likely to come from natural increases. Implementation of Scenario 2A could stimulate about 39 million bushels of new (above trendline) soybean production within Missouri if the additional processing of the soybeans and the soybean oil production were all conducted in Missouri. On a regional basis, it is anticipated that soybean production will see a trendline increase of 100 million bushels from 2020 to 2028. Thus, on a regional basis, there is likely to be enough additional production of soybeans from trendline production to supply the soybean oil needed for Scenario 2A. With 100 million bushels of additional soybean production coming from trendline production increases within the region by 2028, it is likely that some additional soybean processing capacity may be needed to meet increasing livestock demand for protein meals and for increasing domestic biodiesel usage of soybean oil. Processing of 59 million bushels of soybeans would produce 1.298 million tons of soybean meal, which would be an increase of national soybean meal supply of 2.6%. If the ratio of domestic use versus exports of soybean meal continued, the amount of soybean meal from the additional soybean processing would support 1.85% more livestock and poultry production in the U.S.

Scenario 2B: Soybean Oil Impacts

Under Scenario 2B, the demand for soybean oil for biodiesel production to meet the Missouri in-state demand and to maintain current levels of out-of-state shipments rises from 1,283 million pounds to 2,629 million pounds by 2028. Currently, there is enough soybean crush capacity in the region to produce 4,752 million pounds of soybean oil. While the marketing pattern for all of the soybean oil produced in the region is not addressed in this study, production within the region is sufficient to cover the additional soybean oil demand of the Missouri policy initiatives although some changes in existing soybean oil marketing patterns would likely have to occur. If additional soybean oil production were determined to be needed or desired, by 2028 it would take 118 million bushels of increased crush capacity to produce the 1,351 million pounds of soybean oil to make the additional biodiesel.

Scenario 2B: Soybean Production & Processing Impacts

Soybean production in Missouri is expected to increase from 247.6 million bushels in 2020 to 277.3 million bushels by 2028 using national trendline production increases. Thus, 30 million of the 118 million additional bushels needed for Scenario 2B biodiesel consumption are likely to come from natural increases. Implementation of Scenario 2B could stimulate about 88 million bushels of new (above trendline) soybean production within Missouri if the additional processing of the soybeans and the soybean oil production were all conducted in Missouri. On a regional basis, it is anticipated that soybean production will see a trendline increase of 100 million bushels from 2020 to 2028. Thus, on a regional basis, an additional 18 million bushels beyond trendline production would be needed to supply the soybean oil needed for Scenario 2B. With 100 million bushels of additional soybean production coming from trendline production increases within the region by 2028, it is likely that some additional soybean processing capacity may be needed to meet increasing livestock demand for protein meals and for increasing domestic biodiesel usage of soybean oil. This analysis suggests that with increased soybean oil demand for biodiesel use in Missouri due to Scenario 2B, there could be enough demand to support expansion of existing soybean processing capacity by at least 30 million bushels per year and the potential for construction of a new soybean processing plant with at least 50 million bushels of capacity. Regionally, there would be enough additional soybean production and additional soybean oil demand to support 100 million bushels of additional soybean processing capacity.

Scenario 2B: Soybean Meal Production and Impacts on Livestock Production

Under Scenario 2B, up to 118 million bushels of additional soybean processing may occur within the region. Processing of 118 million bushels of soybeans would result in 2.596 million tons of hi-protein soybean meal. This would represent a 5% increase from the approximately 50.4 million tons of soybean meal that are currently produced in the U.S.[1] Of this, 36.8 million tons of soybean meal are fed to livestock and poultry in the United States. Broilers consume about 48% of the soybean meal, followed by hogs (24%), layers (9%), dairy (9%), turkeys (7%), and the rest of animal agriculture (beef, companion animals, aquaculture, sheep and meat goats, etc) round out the last three percent[2]. The February 2020 WASDE report estimates that 13.2 million tons of soybean meal will be exported during the 2019-2020 marketing year.

The own-price elasticity of soybean meal as a feed ingredient varies by species but is relatively elastic meaning that price changes in soybean meal will result in rather small changes in the quantity fed. The own-price elasticity of soybean meal for export is more inelastic (-.392)

[1] From February 2020 USDA WASDE Report

[2] 2019 Soybean Meal Demand Assessment, Prepared for the United Soybean Board by Decision Innovation Solutions, September 2019.

meaning that a 5% increase in quantity will likely result in a 2% decline in the price of soybean meal. Assuming the ratio of domestic-fed meal versus exports remained about the same, the increased soybean meal produced by processing 118 million bushels more soybeans for the soybean oil for biodiesel would support the feeding of 5% more livestock and poultry than is currently fed in the U.S.

Soybean meal, by weight, is about 28% of the typical broiler diet, 16% of the typical layer diet, 24.5% of the typical turkey diet, 15.3% of the typical hog diet and 3% of the typical dairy diet. It is estimated that Missouri livestock and poultry currently consume about 1.268 million tons of soybean meal. Lowering the cost of soybean meal by 2% due to increased soybean processing for soybean oil would result in about $6 per ton savings for livestock producers, or $7.6 million dollars of cost reduction.

Table 4 Soybean Meal Consumption in Missouri

Soybean Meal Consumption in Missouri

Species	Soybean Meal % of Diet	Soybean Meal Consumed (Tons)
Broilers	28.0%	636,891
Layers	16.0%	71,844
Turkey	24.5%	162,377
Hogs	15.3%	373,047
Dairy	3.0%	23,725

Source: 2019 Soybean Meal Demand Assessment, Prepared for the United Soybean Board by Decision Innovation Solutions, September 2019

Neighbor State Biodiesel Production Model

In the Neighbor state model, the total baseline capacity is the sum of Missouri baseline capacity plus all unused existing capacity from the selected eight states. Figure 29 shows the location and the estimated available capacity at the 39 biodiesel plants in 2028 in Missouri and the neighboring states.

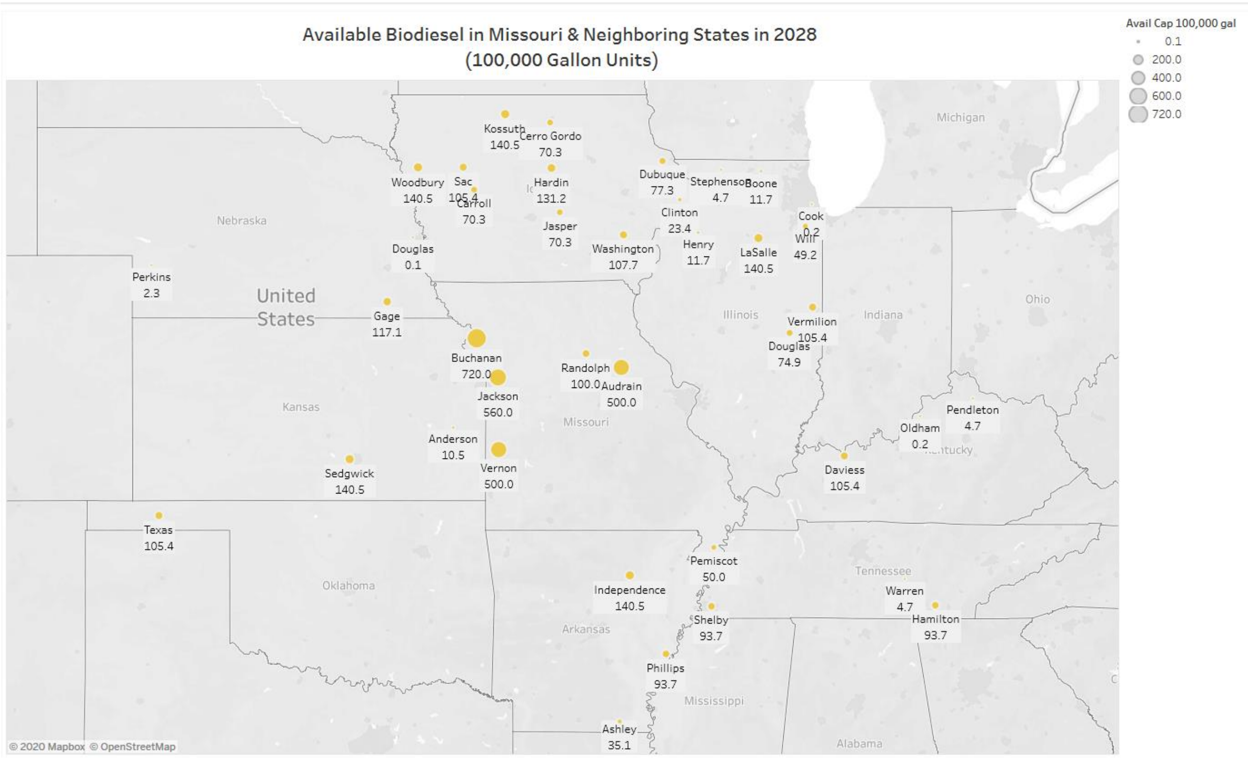


Figure 29 Available Biodiesel in Missouri & Neighboring States in 2028 (100,000 gallon units)

On January 2019, the combined unused existing capacity from the eight states was equal to 253 million gallons per year (see Table 16). The analysis assumed unused plant capacity declines at a 0.0833% rate each month (1% annual rate compounded monthly) starting in February 2019. The 2019 baseline combined capacity (Missouri capacity + unused neighbor state capacity) was equal to 465 million gallons/year (213 million gallons/ year + 252 million gallons/year), by 2028 the combined baseline capacity declined to 444 million gallons /year (213 million gallons/ year + 231 million gallons/year) (see **Error! Reference source not found.**).

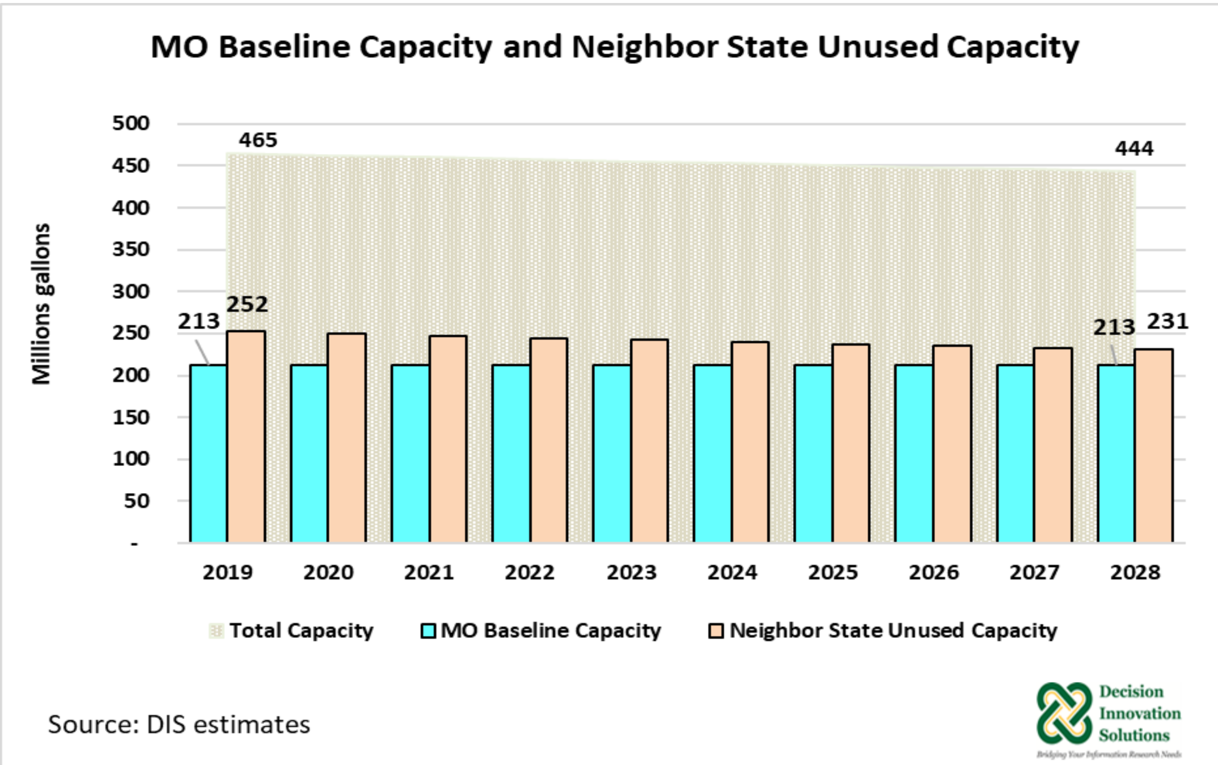


Figure 30, MO Baseline Capacity and Neighbor State Unused Capacity

Baseline Case (B5)

Results of the Baseline case (B5) of the Neighbor biodiesel model are the same as the Baseline case of the Missouri and Regional models except for the capacity utilization. Biodiesel capacity utilization for the region is assumed to be equal to the national average capacity utilization of 74% in 2019. Total capacity in 2019 is the existing Missouri biodiesel capacity (213 million gallons) plus the unused neighboring state capacity (252 million gallons). It is assumed that neighboring state unused capacity declines by 1% annually, compounded monthly, due to increasing biodiesel use in other states and nationally. Under the neighboring state baseline case, capacity utilization rises from 37% to 44% due to baseline increases in biodiesel consumption in Missouri and decreases in unused capacity in the neighboring states from trendline increases in biodiesel usage in those states and nationally (see Figure 31 and Figure 32).

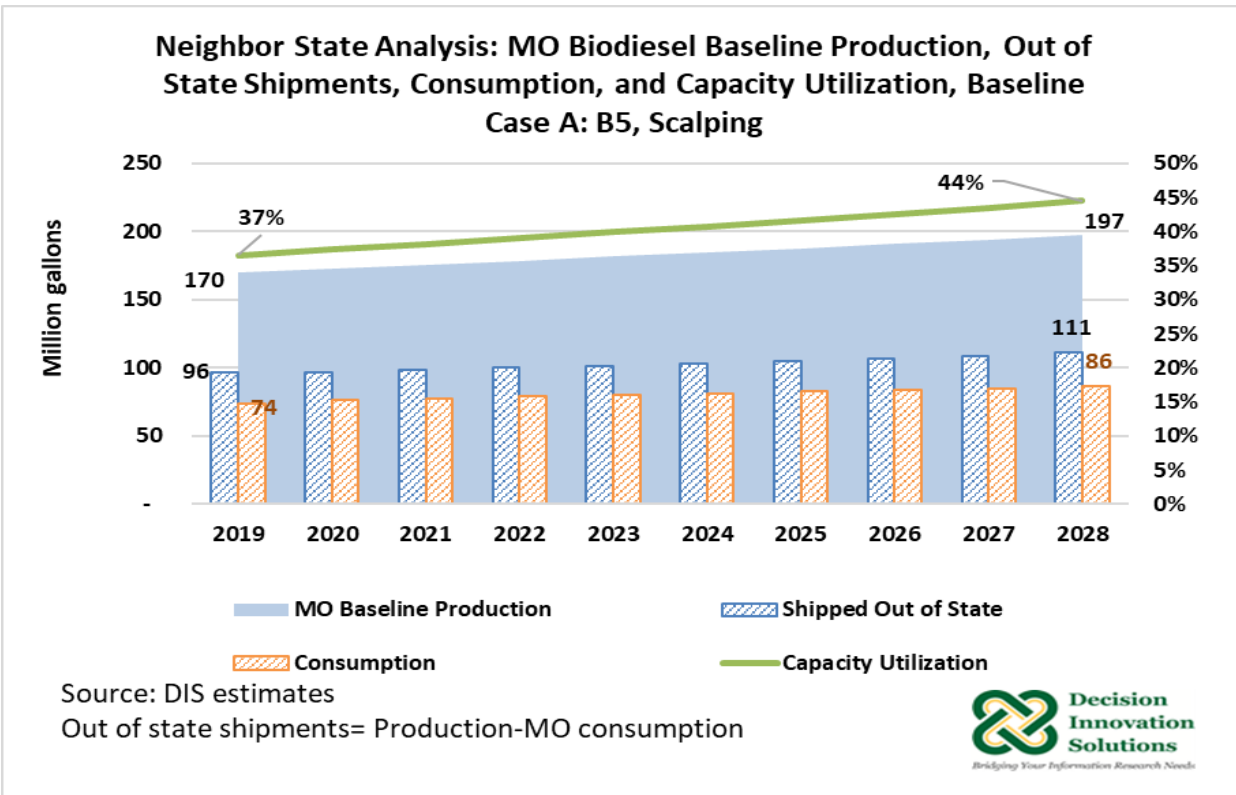


Figure 31, Neighbor State Analysis: MO Biodiesel Baseline Production, Out of State Shipments, Consumption, and Capacity Utilization, Baseline Case A: B5, Scalping

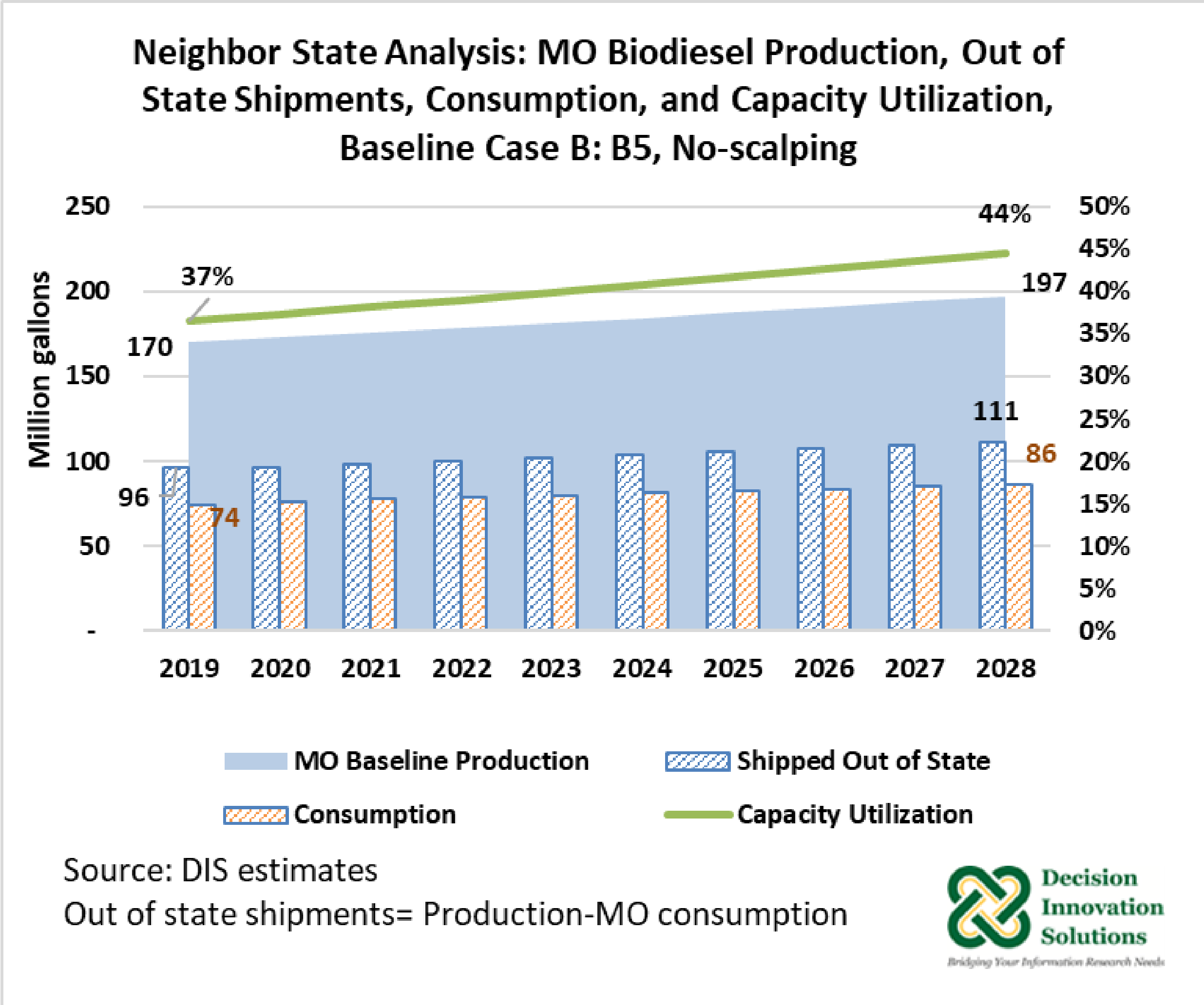


Figure 32, Neighbor State Analysis: MO Biodiesel Production, Out of State Shipments, Consumption, and Capacity Utilization, Baseline Case B: B5, No-scalping

Scenario 1 (B10)

Figure 33 and Figure 34 show the analysis for Scenario 1 (B10) (scalping and no-scalping) of the Neighbor biodiesel model. Given the large amount of capacity available under this model (466 million gallons in 2019 declining to 448 million gallons in 2028), results for the variables analyzed are the same as in the Regional model (see Figure 24) except for the capacity utilization, which in the Neighboring States biodiesel model rises from 37% to 56% for the scalping and no-scalping cases (see Figure 35) compared with 95% in the Regional model (see Figure 25).

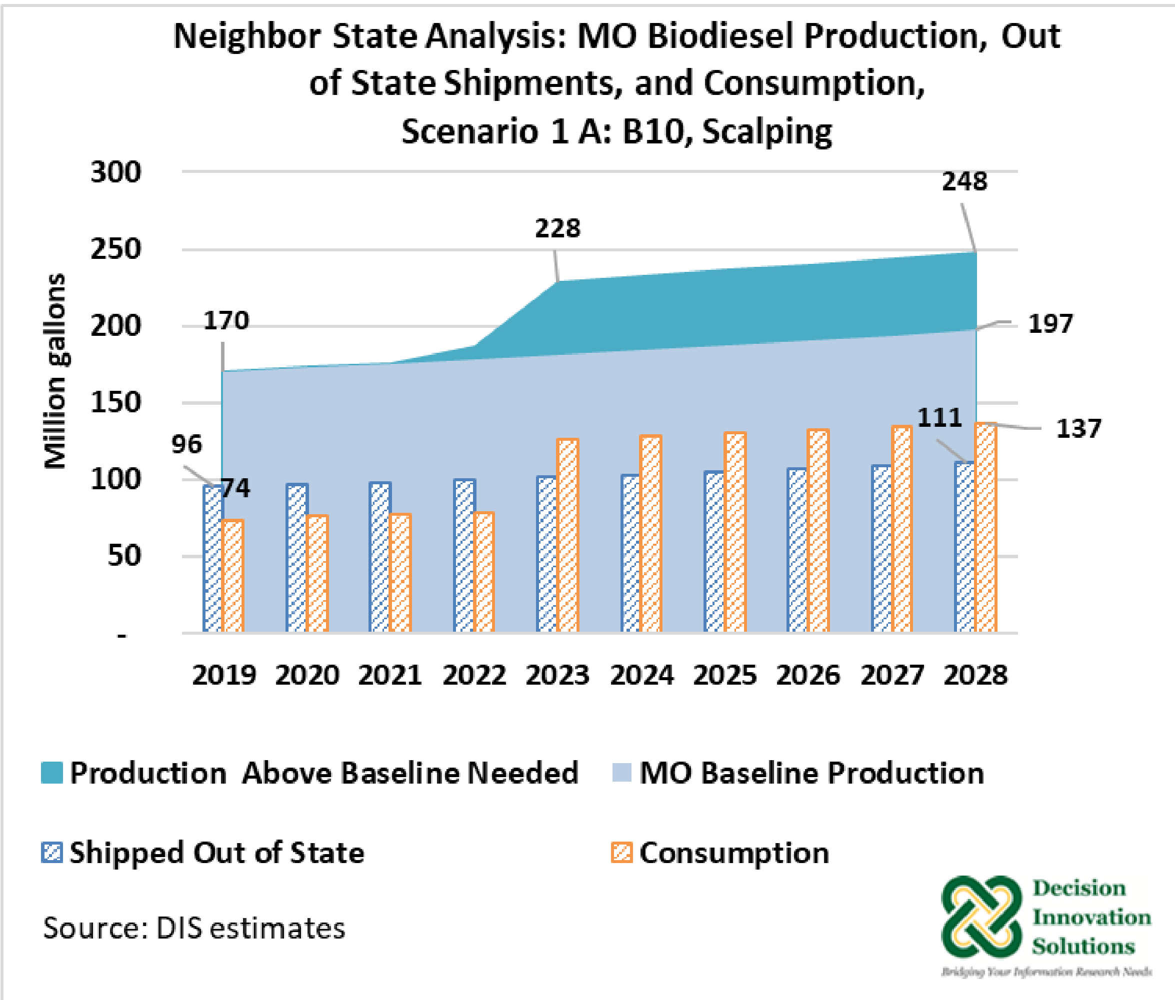


Figure 33, Neighbor State Analysis: MO Biodiesel Production, Out of State Shipments, and Consumption, Scenario 1 A: B10, Scalping

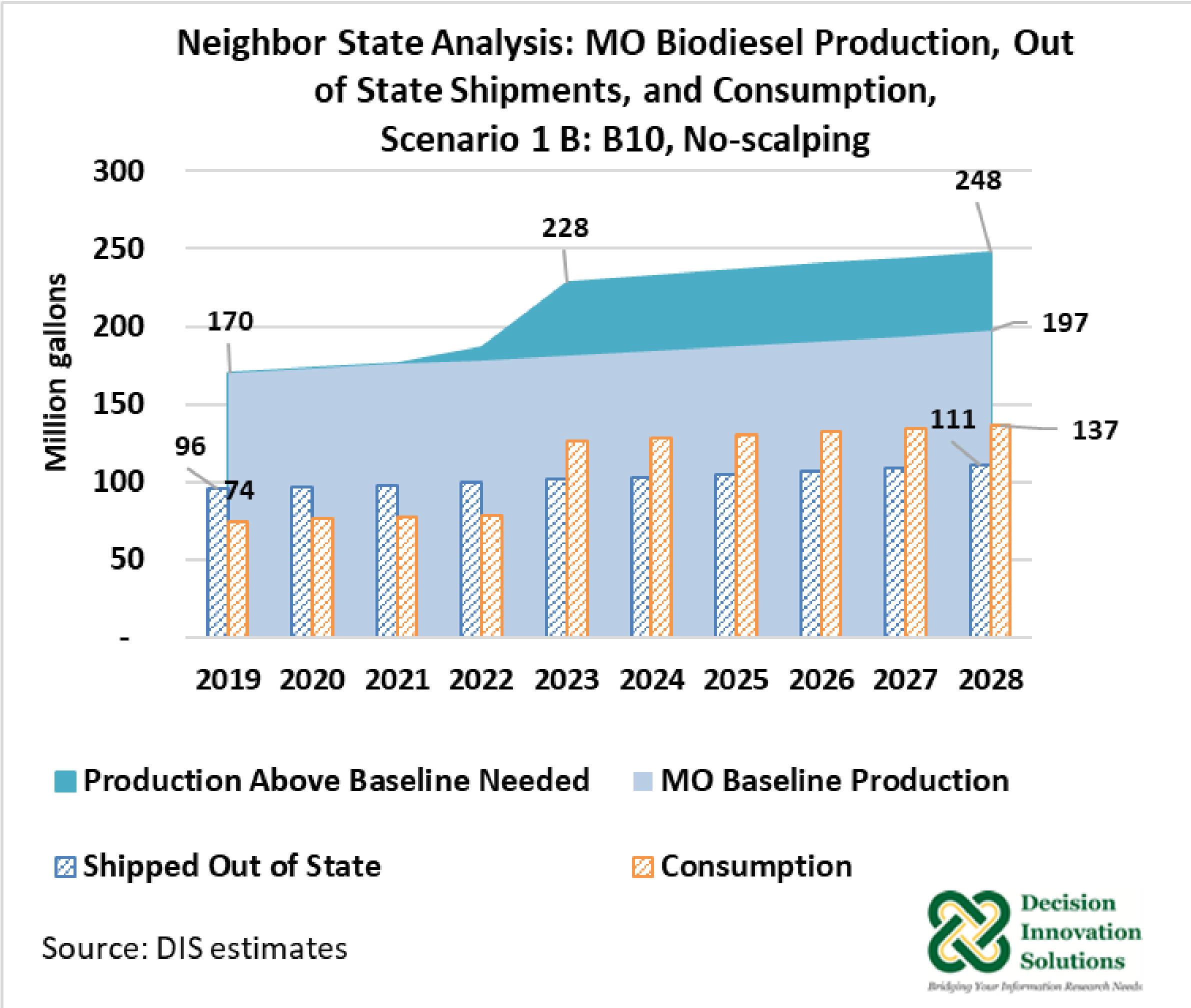


Figure 34, Neighbor State Analysis: MO Biodiesel Production, Out of State Shipments, and Consumption, Scenario 1 B: B10, No-scalping

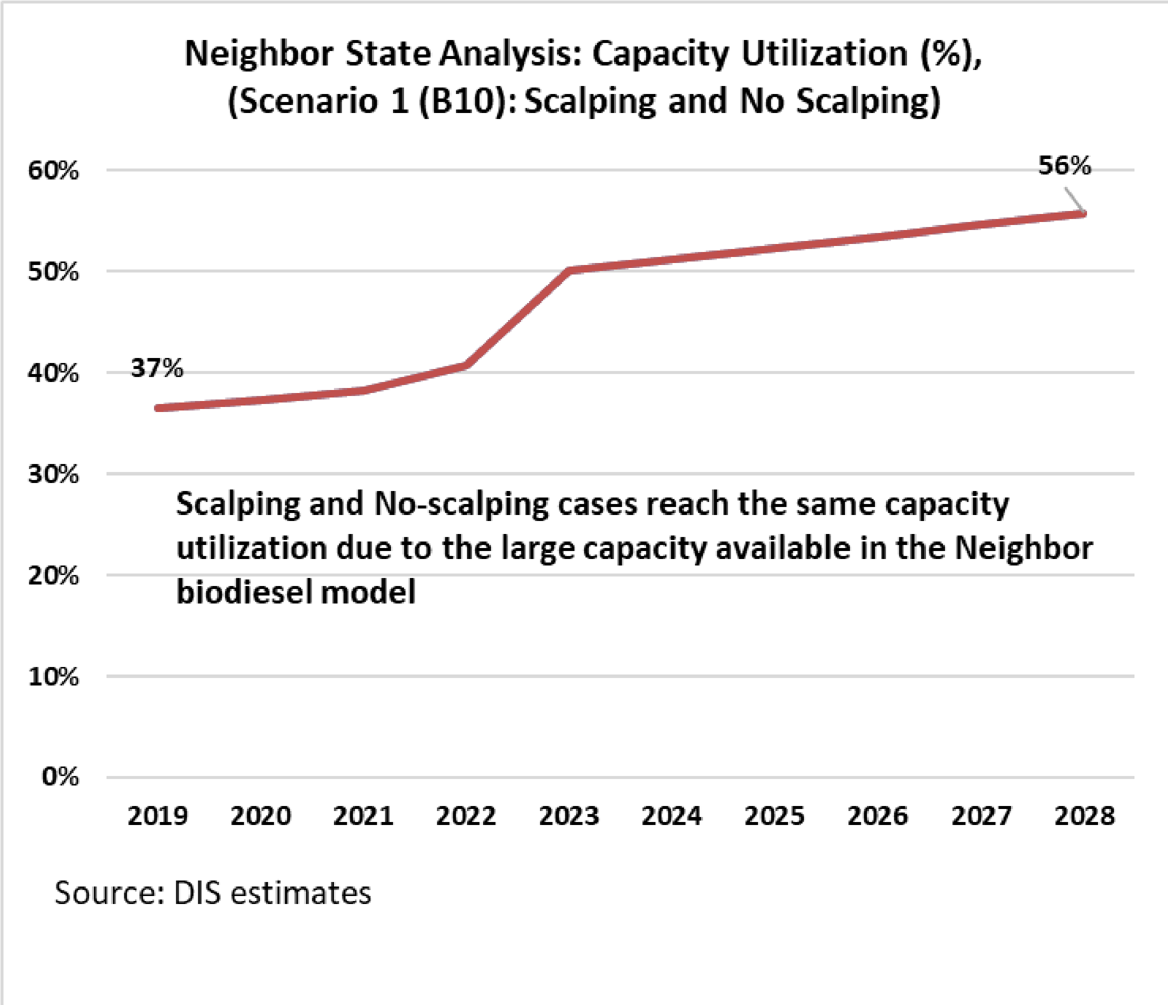


Figure 35, Neighbor State Analysis: Capacity Utilization (%), (Scenario 1 (B10): Scalping and No Scalping)

Scenario 2 (B20)

With plenty of total capacity installed (Missouri plus eight neighbor states -- 466 million gallons in 2019 declining to 448 million gallons in 2028), scalping and no-scalping cases analyses provide the same results (see Figure 36 and Figure 37). In both cases total production (baseline production + above baseline production) moves to a volume of 349 million gallons/year by 2028. That amount of production supplies both domestic (Missouri) and external market (out-of-state shipments) demands while capacity utilization only rises to 79% of total capacity (see Figure 38).

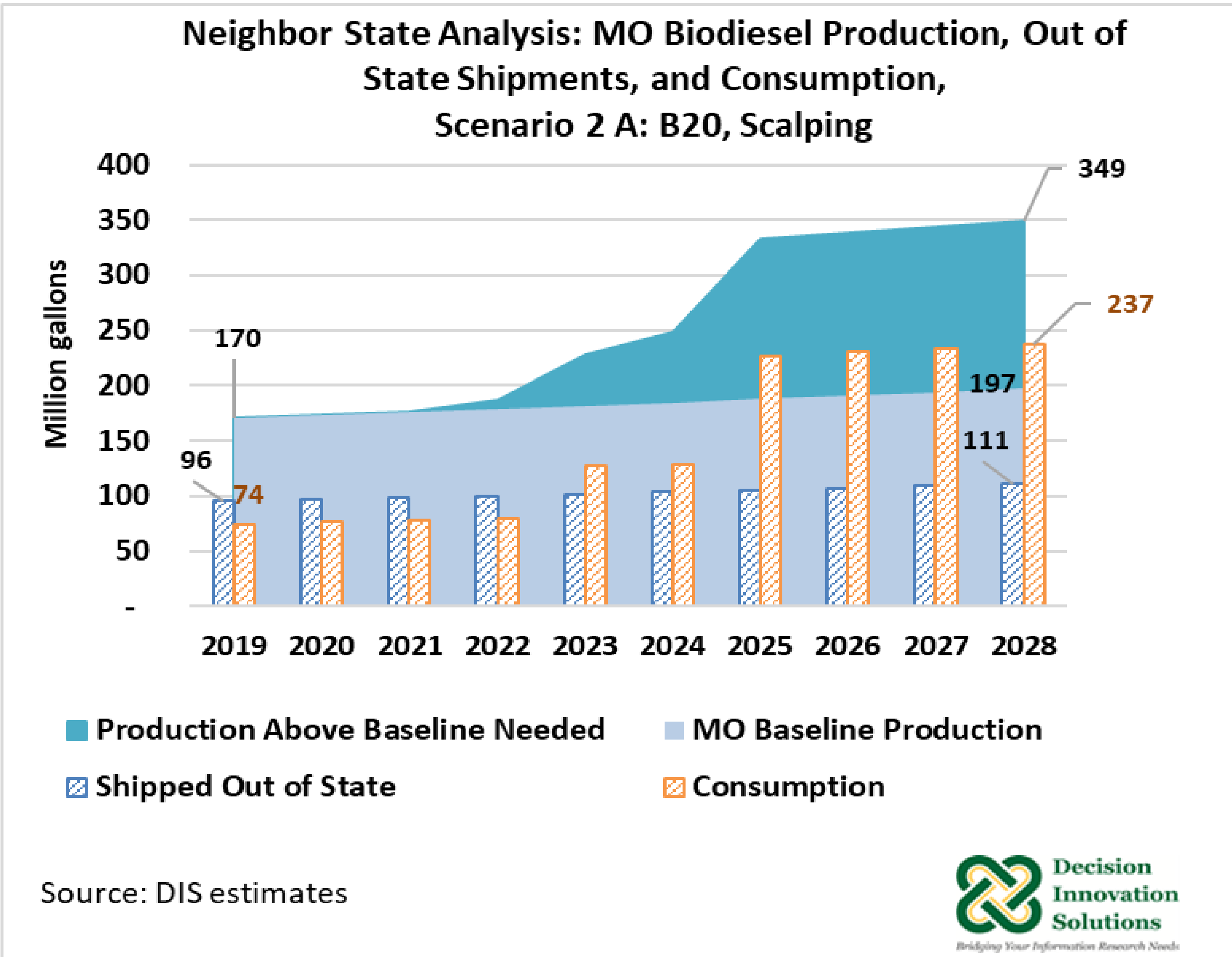


Figure 36, Neighbor State Analysis: MO Biodiesel Production, Out of State Shipments, and Consumption, Scenario 2 A: B20, Scalping

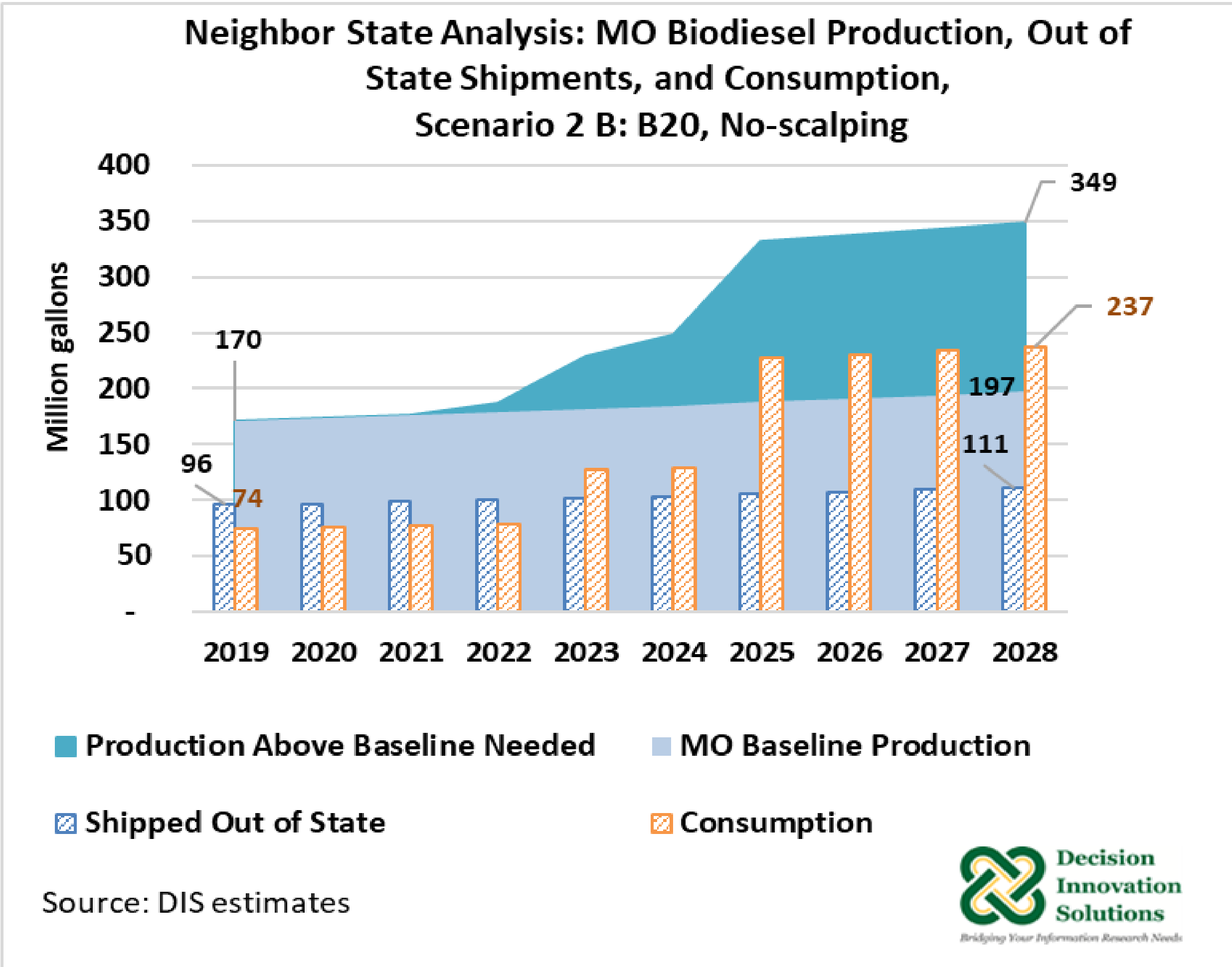


Figure 37, Neighbor State Analysis: MO Biodiesel Production, Out of State Shipments, and Consumption, Scenario 2 B: B20, No-scalping

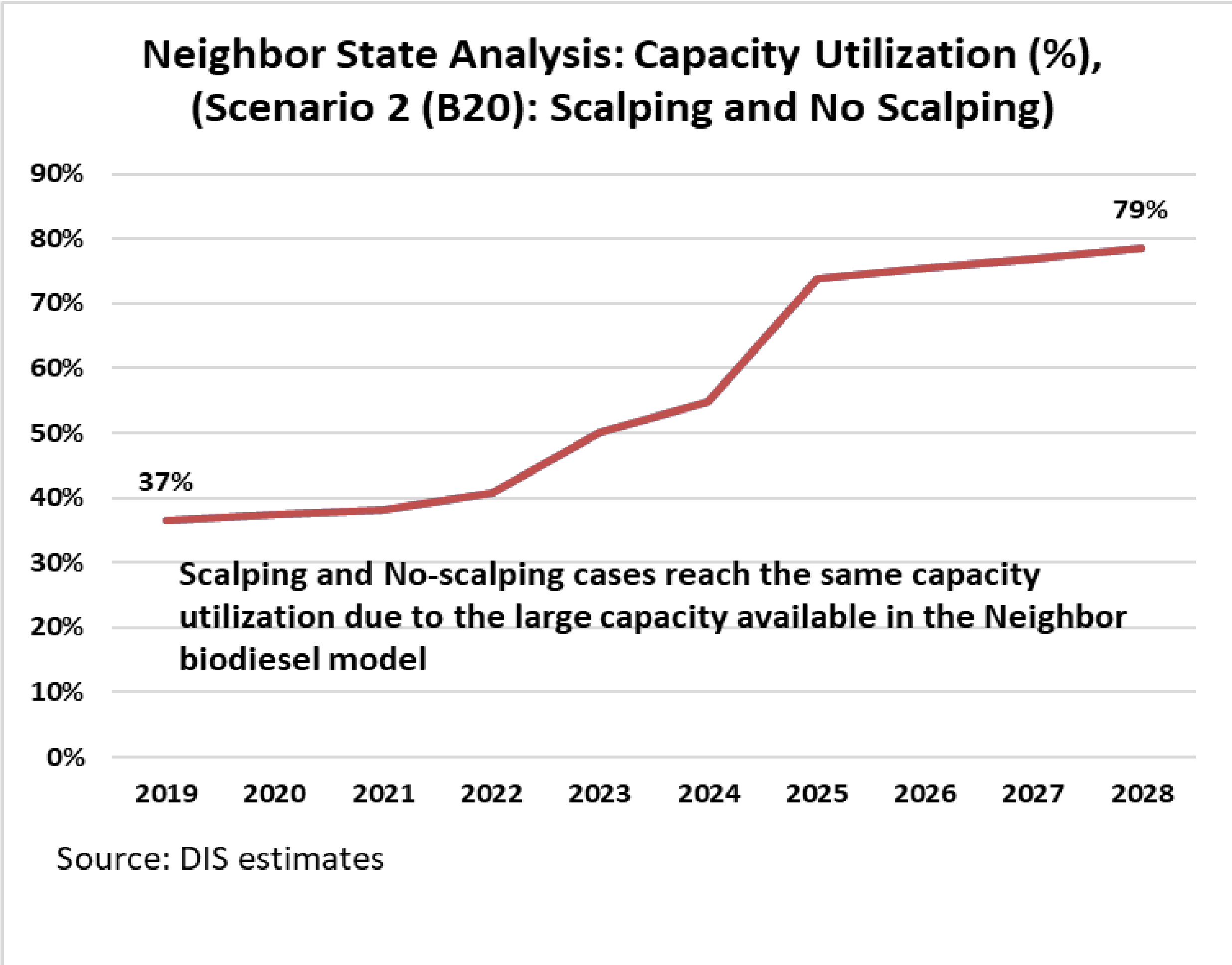


Figure 38, Neighbor State Analysis: Capacity Utilization (%), (Scenario 2 (B20): Scalping and No Scalping)

Economic Impact of Implementation of a Diesel Fuel Standard in Missouri

The term 'economic impact study' implies a change has taken place within a local economy. The change in a local economy typically comes from one of the following sources:

- Entrance/departure of a new business or industry
- Expansion/contraction of an existing business or industry

The entry of a new of expanding industry to Missouri causes a measurable increase in economic activity within the state both in terms of construction and annual operations. The IMPLAN modeling system was used in calculating the following results. These results are shown using common measures of economic activity including:

- Sales (output)
  - The broadest measure of economic activity – sometimes referred to as 'output'
- Value-added
  - Sales (output) minus the cost of inputs
- Employment (jobs)
  - A measure of job positions without regard to whether they are full-time equivalents
- Household Income
  - Income from all sources that accrues to individuals as payment for personal employment (earnings or labor income), payment for ownership interests or capital provision (dividends, interest and rents), or as transfer payments (payments to individuals for which nothing is offered in return)

The direct purchase of supplies and equipment and operational costs are known as the *direct effects*. The suppliers and vendors used by the biodiesel facility to purchase inputs are known as the *indirect effects*. Those who work for the biodiesel facility and their vendors then use their additional income to make household purchases; these are known as household, or *induced effects*. Taken together, the sum of direct, indirect, and induced effects are known as the *total effects* and account for the total multiplier effect present from the change to the industry.

Based on the previous analyses, three scenarios were identified to model the economic impact of the following potential changes to the biodiesel industry in Missouri.

- Construction and operations of increasing production of existing plants by 43 million gallons per year and increasing storage to meet needs of additional production from the new plant and existing plants (2024)

- Construction and operations of a new biodiesel plant producing 50 million gallons per year and increasing production of existing plants by 43 million gallons per year (2024)
- Construction and operations of a new biodiesel plant producing 50 million gallons per year (2024)

Economic Impacts of Increasing Production at Existing Plants by 43 Million Gallons per Year

Under this scenario there is an operations impact. This assumes the existing biodiesel plants increase production by 43 million gallons per year. The operations impact of the additional production is an annual impact which would occur every year, not just one-time impact like construction. Using the methodology and assumptions outlined in this report, the estimated total value-added impact for operations for the first year, as shown in **Error! Reference source not found.**, was $53.7 million. Estimates of value added is an accurate indicator of the biodiesel industries ability to improve economic prospects for the local economy. In terms of jobs, 498 total jobs would be supported in Missouri each year because of additional operations from existing plants and the operations of the new plant. $206.3 million in total sales economic activity would occur within Missouri each year.

Table 5, Operations for First Year Impact of Increased Production at Existing Plants

Operations for First Year				
Impact Type	Employment	Labor Income	Value Added	Sales
Direct Effect	89	$9,416,353	$18,311,184	$135,728,033
Indirect Effect	276	$14,247,544	$24,338,233	$50,820,597
Induced Effect	133	$6,286,904	$11,013,359	$19,707,511
Total Effect	498	$29,950,801	$53,662,776	$206,256,140

Economic Impact of Additional Biodiesel Storage

This scenario only looked at the impact of the additional storage needed for the increased biodiesel production and impact of increasing biodiesel production at existing plants. Construction of the additional storage for the existing plants and the new plant by 53 million gallons is a one-time impact and not annual ongoing impacts. Fifty-three million gallons of storage in addition to the 10 million gallons of storage at the new plant will be constructed. Using the methodology and assumptions outlined in this report, the estimated total value-added impact for construction of the additional storage, as shown in Table 6 was $41.3 million. Estimates of value added is an accurate indicator of the biodiesel industries ability to improve economic prospects for the local economy. In terms of jobs, 891 total jobs will be supported in Missouri because of construction of the new plant. About ninety-three million ($92.7) in total sales economic activity occurs within Missouri.

Table 6, Total Impact Results, Construction Impact of Additional Storage Needed for Increased Production

Construction				
Impact Type	Employment	Labor Income	Value Added	Sales
Direct Effect	557	$33,308,510	$12,094,440	$38,556,324
Indirect Effect	107	$6,602,613	$10,483,406	$20,535,363
Induced Effect	227	$10,720,469	$18,769,314	$33,586,893
Total Effect	891	$50,631,592	$41,347,160	$92,678,580

Please see Appendix E for a handout outlining these economic impacts.

Economic Impacts of Increasing Production by 43 Million Gallons, Building a New 50 Million Gallon Plant, and Building 53 Million Gallons of Additional Storage

Since there is already a biodiesel presence in Missouri, this scenario looked at the economic impact of an increase in the industry. This assumes that the existing facilities ramp up production to utilize unused capacity of 43 million gallons. Included in this scenario is a new biodiesel plant producing 50 million gallons per year. For this scenario there is a need to increase storage for biodiesel by 53 million gallons in addition to the 10 million gallons of storage on the new biodiesel plant which would cause additional construction impacts. Construction impacts are one-time occurrences and not annual ongoing impacts. Using the methodology and assumptions outlined in this report, the estimated total value-added impact for construction, as shown in Table 7 was $88.2 million. Estimates of value added is an accurate indicator of the biodiesel industry's ability to improve economic prospects for the local economy. In terms of jobs, 1,825 total jobs will be supported in Missouri because of construction for storage and the new plant. $194.8 million in total sales economic activity occurs within Missouri.

Table 7, Total Impact Results, Construction Impact of New Plant and Increased Biodiesel at Existing Plants

Construction				
Impact Type	Employment	Labor Income	Value Added	Sales
Direct Effect	1,129	$68,624,056	$27,363,713	$82,450,903
Indirect Effect	227	$13,944,867	$22,010,233	$42,967,948
Induced Effect	469	$22,159,209	$38,797,698	$69,426,736
Total Effect	1,825	$104,728,132	$88,171,644	$194,845,587

Under this scenario there is an operations impact as well as the construction impact. This assumes that the existing facilities ramp up production to utilize unused capacity of 43 million gallons. This scenario included a new biodiesel plant producing 50 million gallons per year. The operations impacts of the new plant and increased production from existing facilities are annual impacts which would occur every year, not just one-time impacts like construction. Using the methodology and assumptions outlined in this report, the estimated total value added impact for operations for the first year, as shown in Table 8, was $116.1 million. Estimates of value added is an accurate indicator of the biodiesel industry's ability to improve economic prospects for the local economy. In terms of jobs, 1,076 total jobs would be supported in Missouri each year because of additional operations from existing plants and the operations of the new plant. $446.1 million in total sales economic activity would occur within Missouri each year.

Table 8, Total Impact Results, Operations for First Year Impact of New Plant and Increased Biodiesel at Existing Plants

Operations for First Year				
Impact Type	Employment	Labor Income	Value Added	Sales
Direct Effect	192	$20,365,600	$39,603,259	$293,551,326
Indirect Effect	596	$30,814,456	$52,638,504	$109,914,314
Induced Effect	288	$13,597,257	$23,819,591	$42,623,221
Total Effect	1,076	$64,777,313	$116,061,354	$446,088,861

Please see Appendix E for a handout outlining these economic impacts.

Economic Impact of New Biodiesel Plant

This scenario only looked at the impact of a new biodiesel plant producing 50 million gallons per year. Construction of the new biodiesel plant is a one-time impact and not annual ongoing impacts. Using the methodology and assumptions outlined in this report, the estimated total value added impact for construction of the new biodiesel plant, as shown in Table 9, was $46.8 million. Estimates of value added is an accurate indicator of the biodiesel industry's ability to improve economic prospects for the local economy. In terms of jobs, 934 total jobs will be created in Missouri because of construction of the new plant. $102.2 million in total sales economic activity occurs within Missouri.

Table 9, Total Impact Results, Construction Impact of New Plant

Construction				
Impact Type	Employment	Labor Income	Value Added	Sales
Direct Effect	572	$35,315,546	$15,269,273	$43,894,579
Indirect Effect	120	$7,342,254	$11,526,827	$22,432,586
Induced Effect	242	$11,438,740	$20,028,385	$35,839,843
Total Effect	934	$54,096,540	$46,824,484	$102,167,007

Under this scenario there is an operations impact as well as the construction impact. This assumes the new biodiesel plant is producing 50 million gallons per year. The operations impact of the new plant is an annual impact which would occur every year, not just one-time impact like construction. Using the methodology and assumptions outlined in this report, the estimated total value added impact for operations for the first year, as shown in Table 10, was $62.4 million. Estimates of value added is an accurate indicator of the biodiesel industries ability to improve economic prospects for the local economy. In terms of jobs, 579 total jobs would be supported in Missouri each year because of additional operations from existing plants and the operations of the new plant. $239.8 million in total sales economic activity would occur within Missouri each year.

Table 10, Operations for First Year Impact of New Plant

Operations for First Year				
Impact Type	Employment	Labor Income	Value Added	Sales
Direct Effect	103	$10,949,247	$21,292,075	$157,823,294
Indirect Effect	321	$16,566,912	$28,300,271	$59,093,717
Induced Effect	155	$7,310,353	$12,806,232	$22,915,710
Total Effect	579	$34,826,512	$62,398,577	$239,832,721

Dynamic Flow Analysis of Biodiesel

The Dynamic Flow Analysis for biodiesel in Missouri models the flows of biodiesel from the soy-based biodiesel production facilities in Missouri and the CRDs of Iowa, Illinois, Kentucky, Tennessee, Arkansas, Oklahoma, Kansas and Nebraska that immediately abut Missouri to calculated biodiesel consumption in each of the counties of Missouri.

Diesel Use by County

County level consumption was calculated as the combination of state-level totals of highway diesel use and non-highway diesel use allocated to the counties based on the following allocation methods:

County Highway Diesel Use = State Highway Diesel Use multiplied times each county's share of average daily truck traffic. Average daily truck traffic was calculated from data provided by the Missouri Department of Transportation regarding traffic that crosses the bridges in the state, and information for the number of registered gasoline & diesel powered vehicles in Missouri was obtained through the Missouri Department of Revenue.

County Nonhighway Diesel Use = State Nonhighway Diesel Use multiplied times each county's share of 100+ horse-power tractors as reported in the USDA 2017 Census of Agriculture.

County Diesel Use

Figure 39 shows estimated diesel usage by county for the state of Missouri in 2019. In 2019 a total of 1,207 million gallons of diesel fuel was sold in Missouri for highway use. A total of 271 million gallons were sold for nonhighway use. Diesel fuel for highway usage is allocated to counties based on each county's share of average daily truck traffic as calculated from bridge traffic data from the Missouri Department of Transportation. Nonhighway diesel use for each county was allocated based on each county's share of 100+ horsepower tractors as reported in the 2017 Census of Agriculture by USDA.

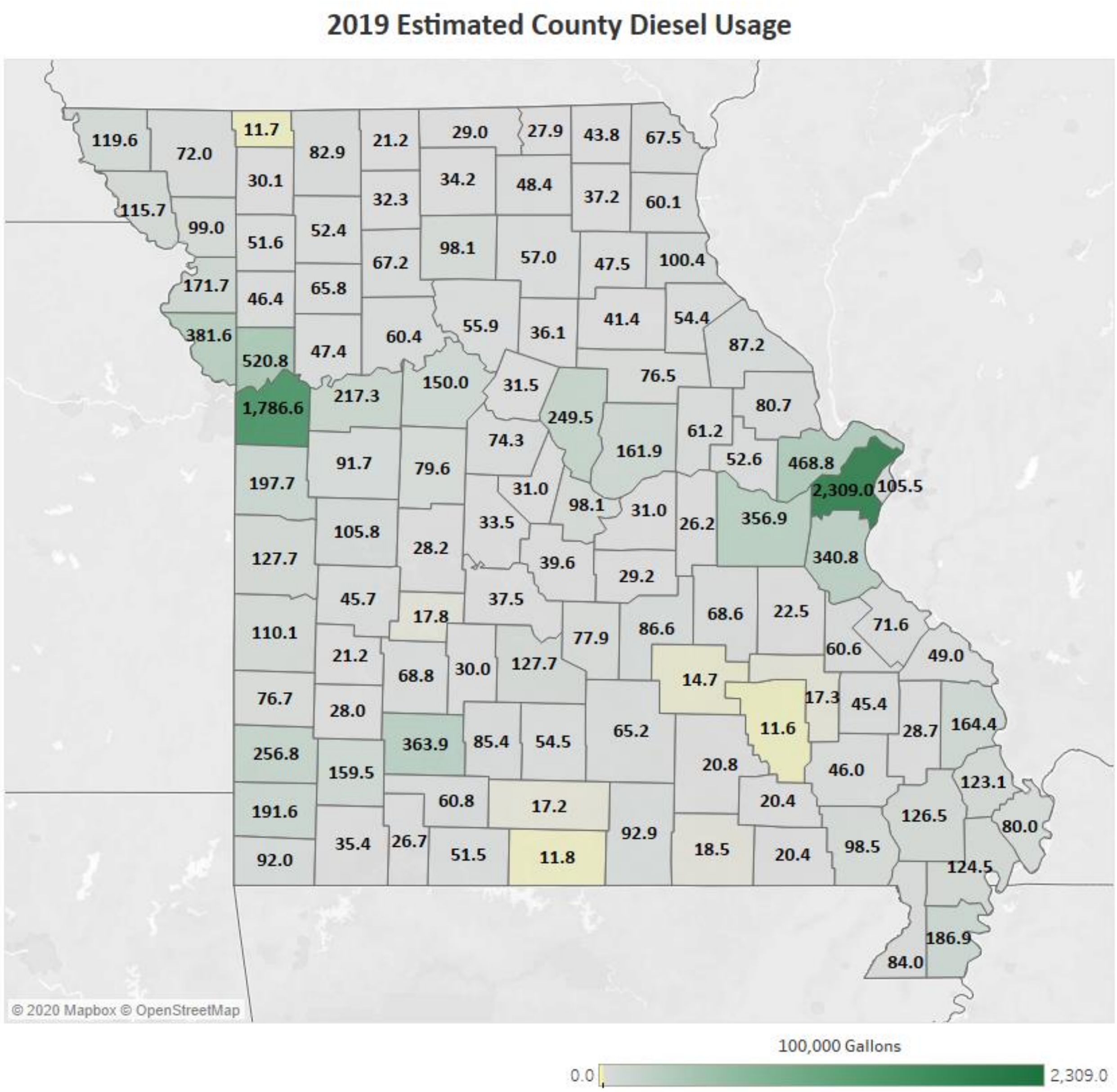


Figure 39, 2019 Estimated County Diesel Usage

For 2028, total state highway diesel fuel use is estimated to be 1,429 million gallons. Nonhighway use is estimated to be 296 million gallons. The allocations of state diesel use to each county used the same allocation percentages as the 2019 diesel use allocations.

2028 Estimated County Diesel Usage

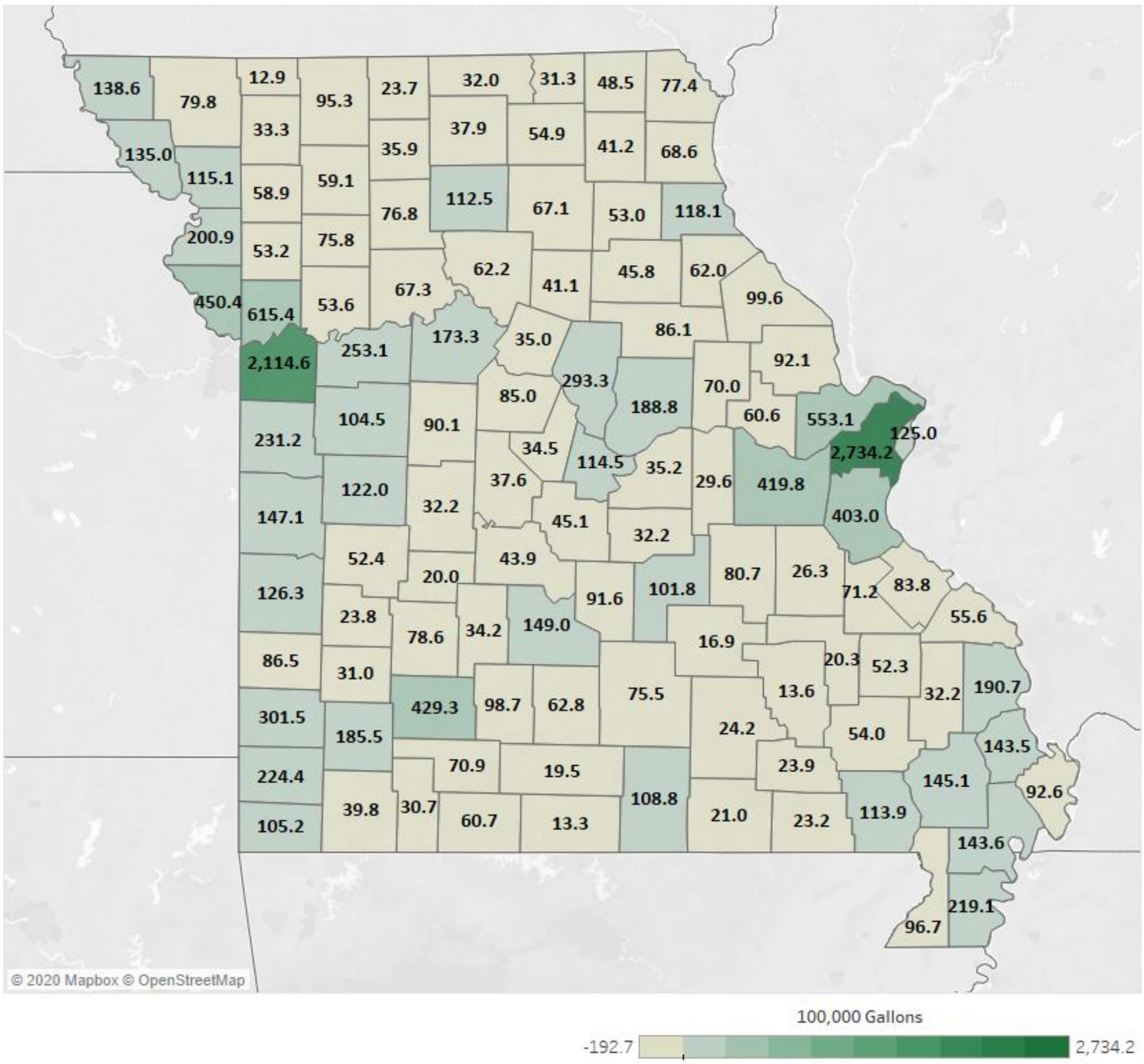


Figure 40, 2028 Estimated County Diesel Usage

Biodiesel Usage

In 2019, it is estimated that the average blend rate for biodiesel is 5% in Missouri. Biodiesel use in Missouri for 2019 is estimated as 5% multiplied times the gallons of diesel use in each county. In 2019, it is estimated that approximately 74 million gallons of biodiesel were used in Missouri.

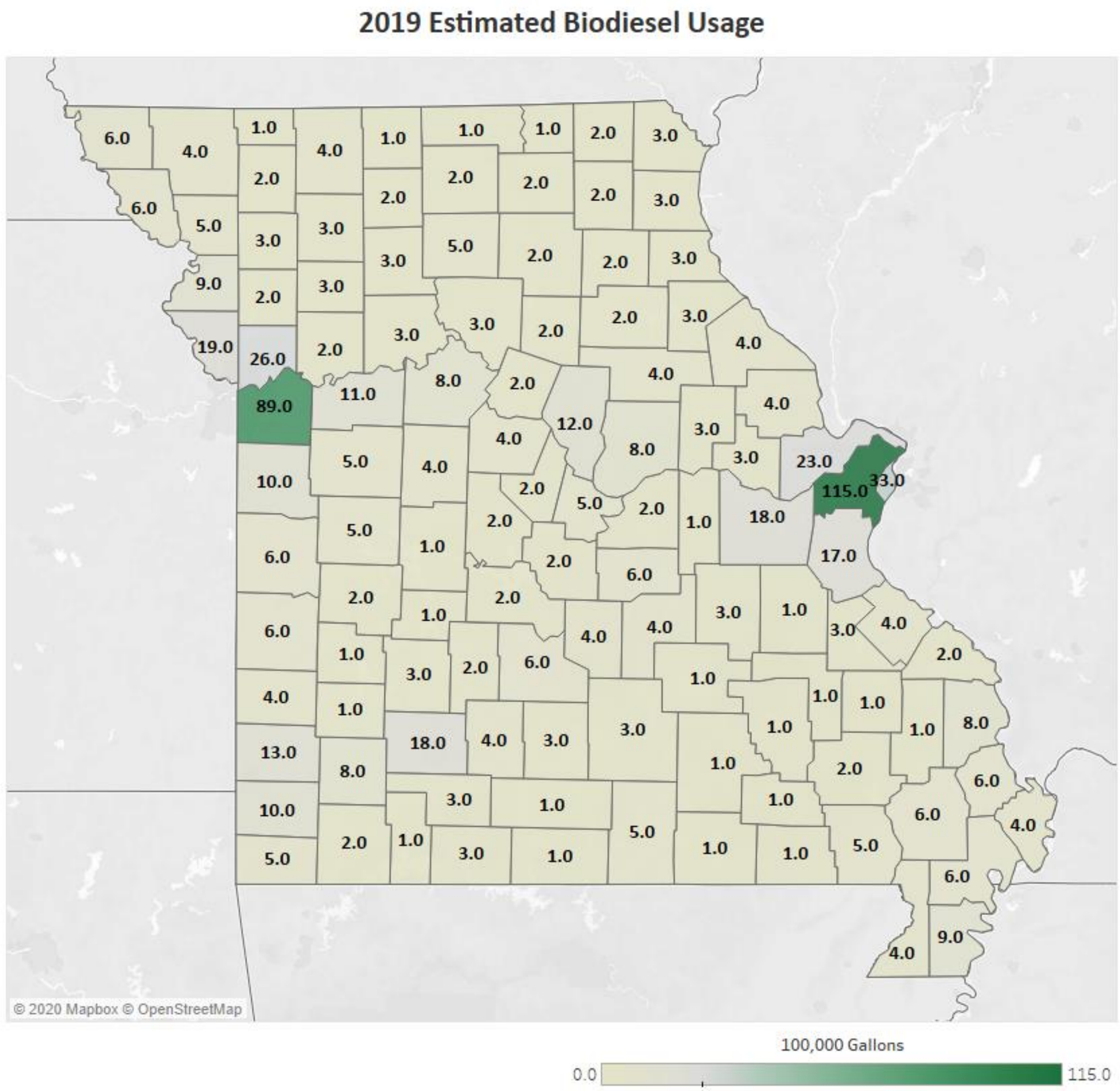


Figure 41, 2019 Estimated Biodiesel Usage

Biodiesel use in Missouri in 2028 (Figure 42) is estimated to be 237.3 million gallons based on Scenario 2 (B20 blends in use for 7 months of the year). Biodiesel use is allocated to the counties according to the same percentages as diesel fuel allocations for 2028.

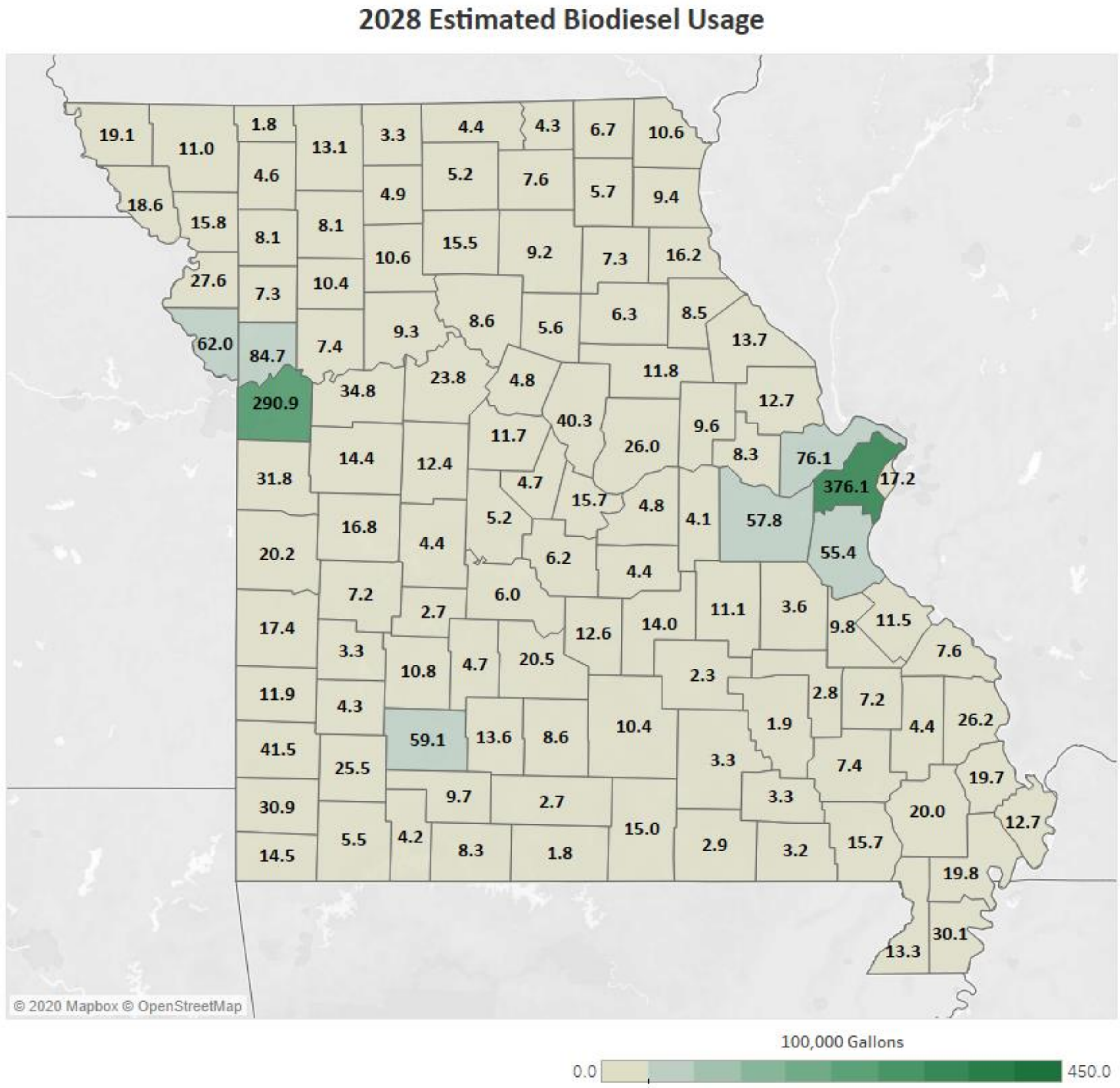


Figure 42, 2028 Estimated Biodiesel Usage

Figure 43 shows current (2019) soy-based biodiesel production capacity by county. (Note: there is approximately 30 million gallons of biodiesel production capacity not shown on this map since it uses primarily non-soybean feedstocks for biodiesel production.) Biodiesel production capacity in December 2019 was reported to be 213 million gallons with about 170 million gallons of annual production by these facilities in 2019.

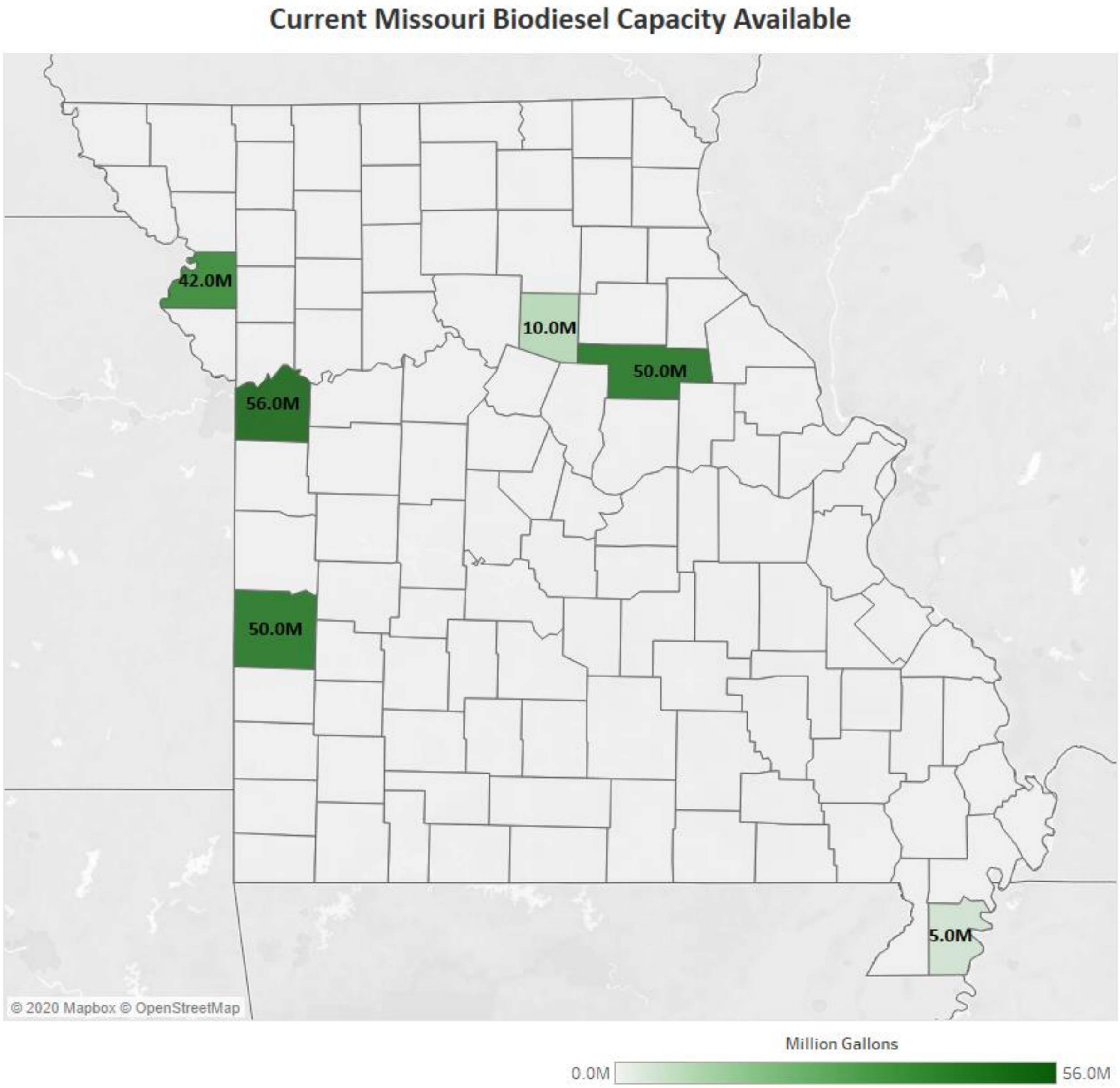


Figure 43, Current Missouri Soy-based Biodiesel Capacity Available

In 2019, it is estimated that 1.283 billion pounds of soybean oil were used for biodiesel production in Missouri. In 2028, under Scenario 2B, all Missouri soybean oil-based biodiesel facilities would be operating at capacity. Figure 44 shows the amount of soybean oil that would be used by each facility. In 2028, a total of 1.608 billion pounds of soybean oil would be used by Missouri biodiesel production facilities.

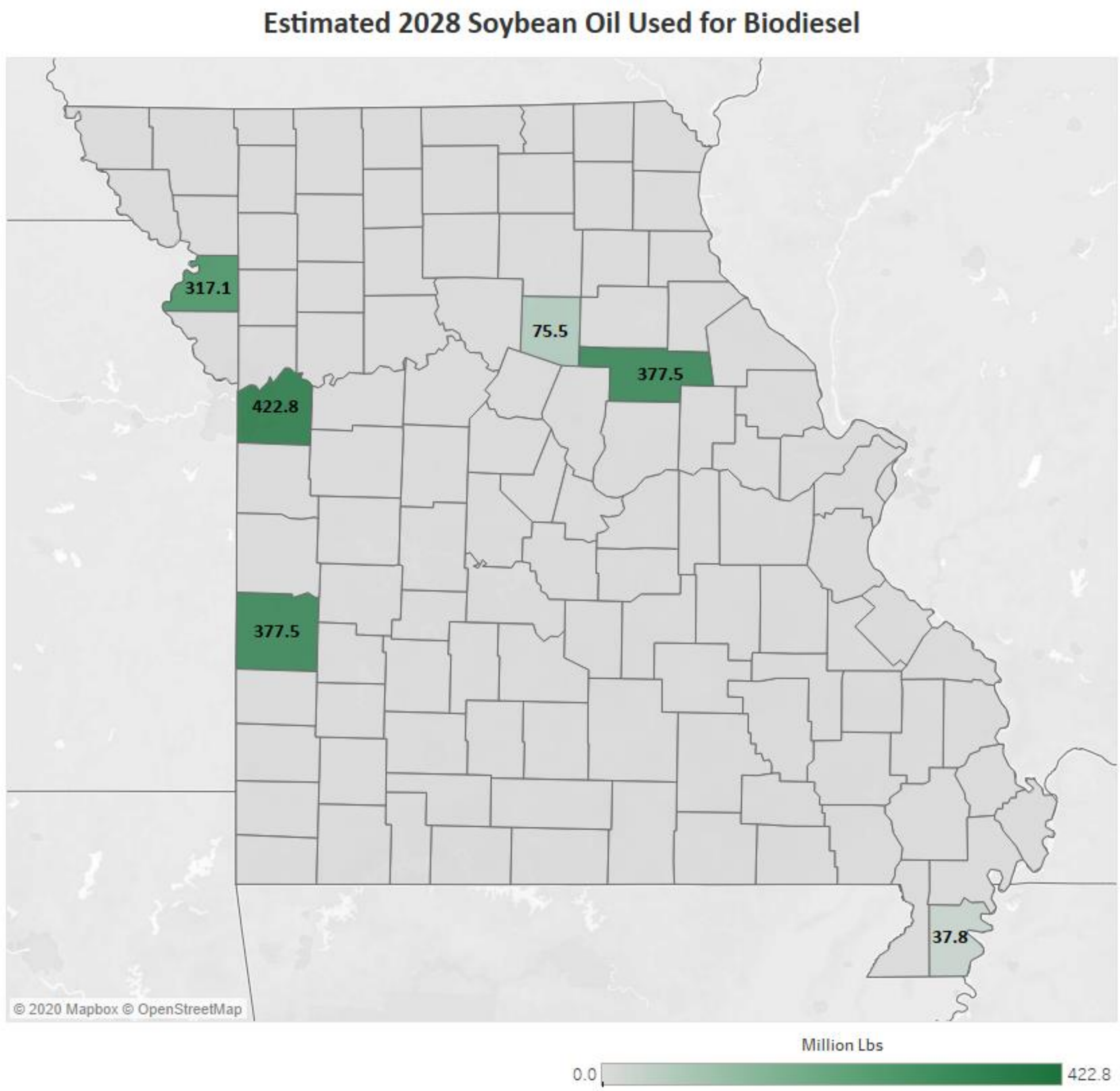


Figure 44, Estimated 2028 Soybean Oil Used for Biodiesel

It is estimated that Missouri currently has the capacity to produce 2,199.86 million pounds of soybean oil. Figure 45 shows the location and quantity of soybean oil production that is possible by Missouri soybean processing facilities.

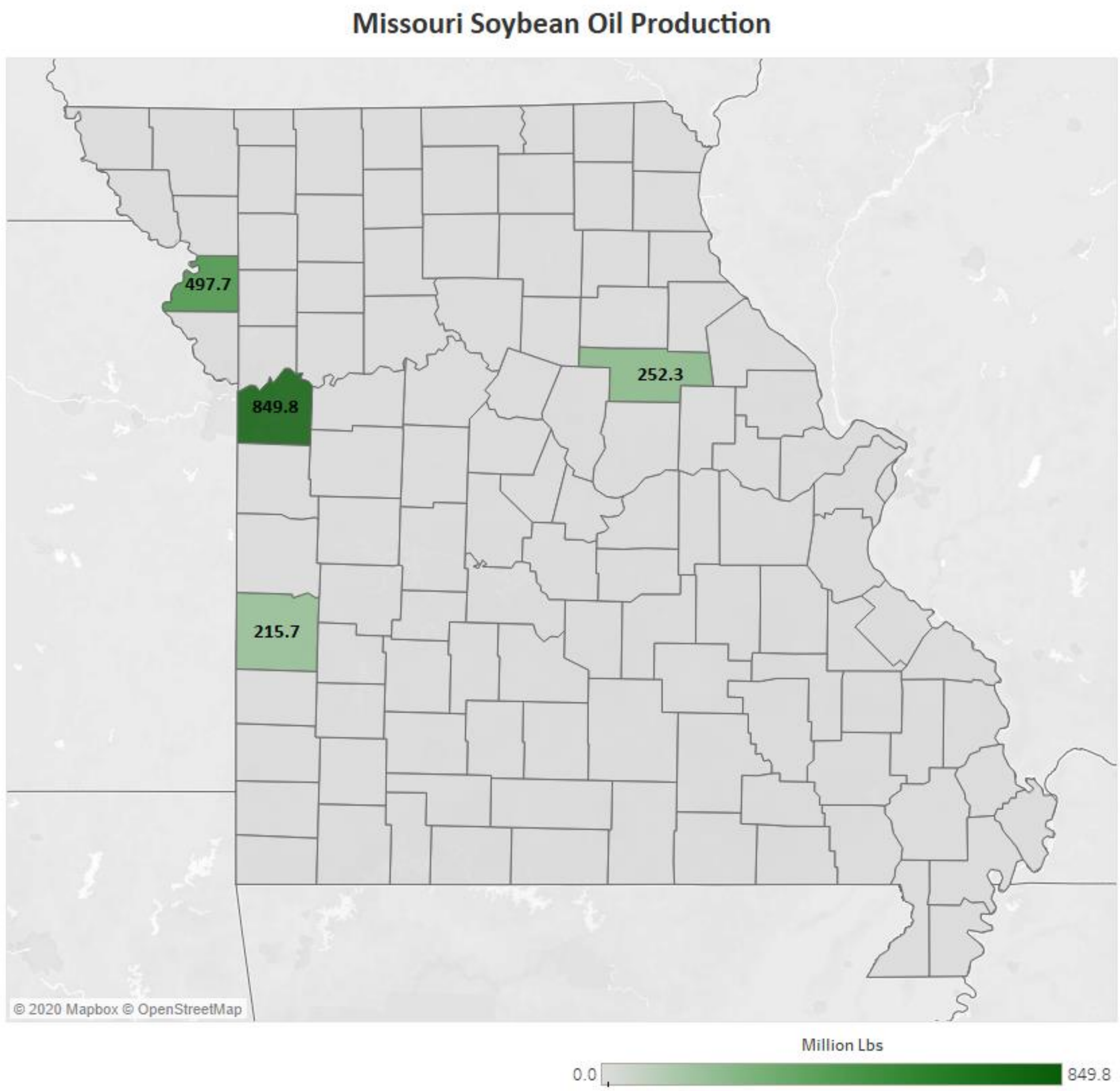


Figure 45, Missouri Soybean Oil Production

Figure 46 shows the surplus/deficit of soybean oil available for soybean-based biodiesel production in each of the counties with soybean processing facilities and/or soybean-based biodiesel production facilities.

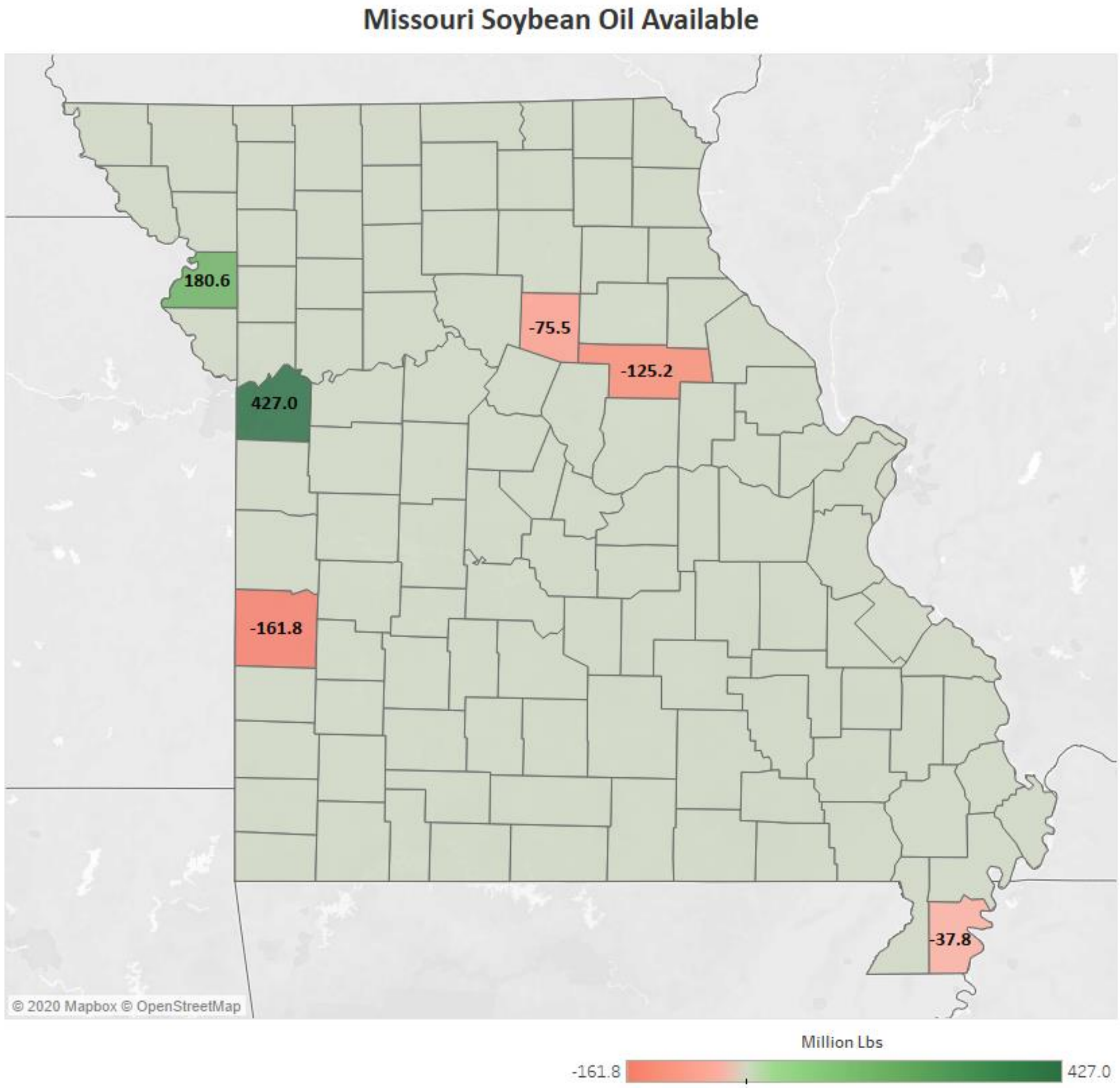


Figure 46, Missouri Soybean Oil Available

Missouri has 191 million bushels of soybean processing capacity spread out among facilities in 5 counties.

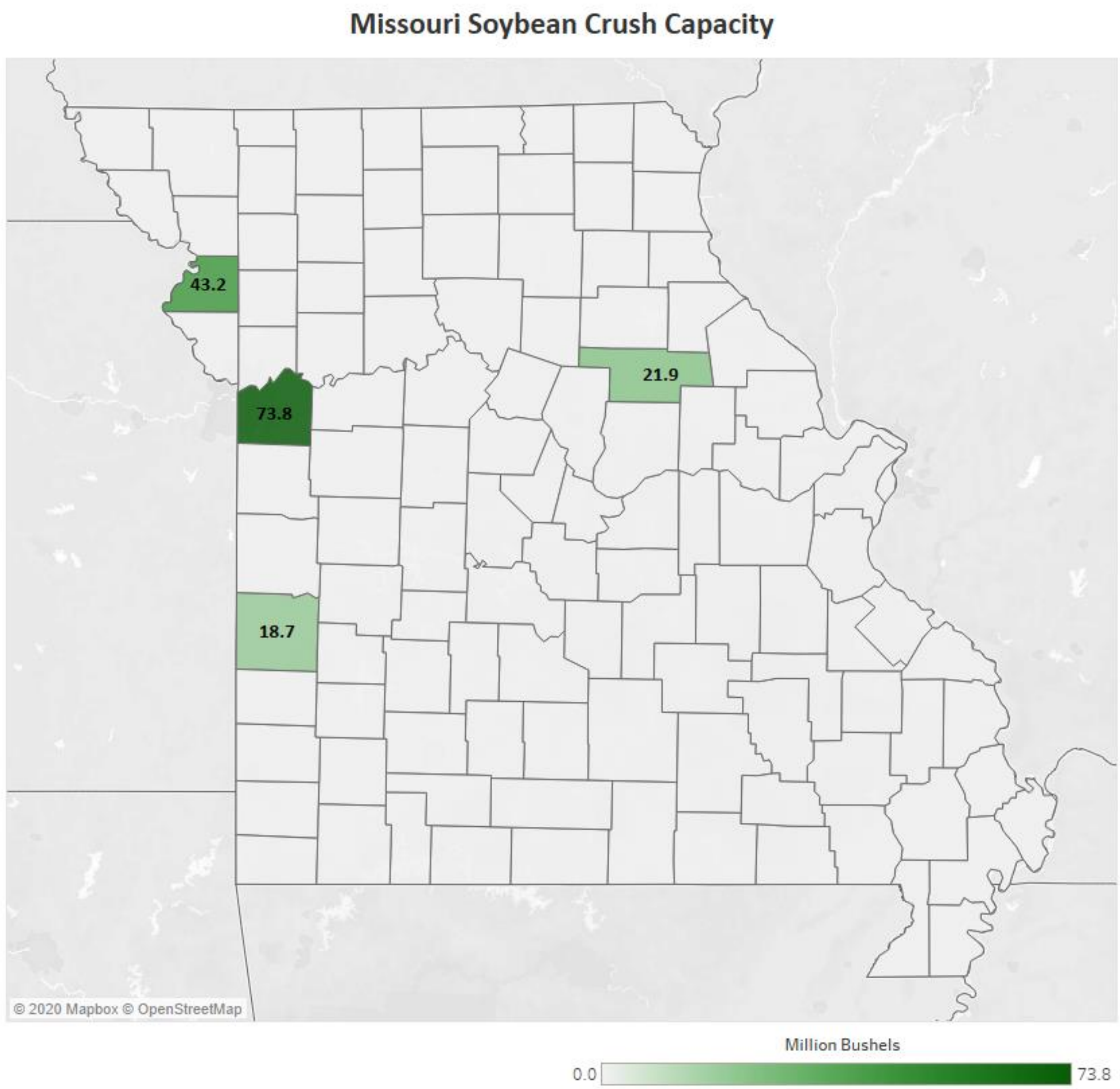


Figure 47, Missouri Soybean Crush Capacity

In 2019, it is estimated that Missouri produced 170 million gallons of soy-based biodiesel. It is estimated that 73.895 million gallons of biodiesel were used in Missouri in 2019 and that 96.105 million gallons were marketed out-of-state in 2019. Figure 48 shows the estimated county use of biodiesel in Missouri in 2019 with 4 additional "out-of-state" demand points added to assist in allocating biodiesel flows from Missouri's biodiesel production facilities.

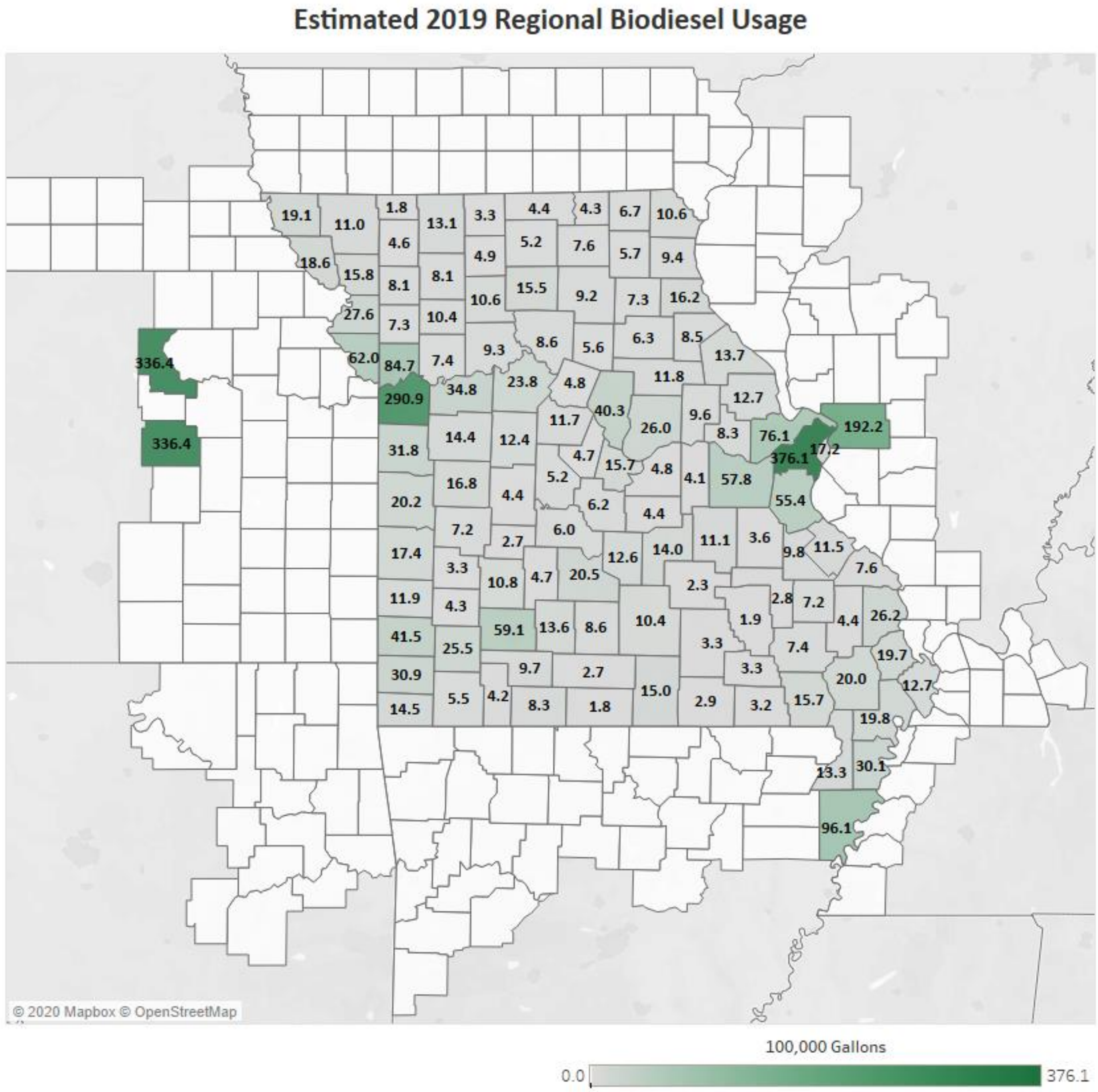


Figure 48, Estimated 2019 Regional Biodiesel Usage

Figure 49 shows estimated Missouri biodiesel use (plus 4 out-of-state consumption data points) in 2028 that is used for the biodiesel flow analysis. Biodiesel production for the 2028 flow analysis comes from the plants in Figure 51.

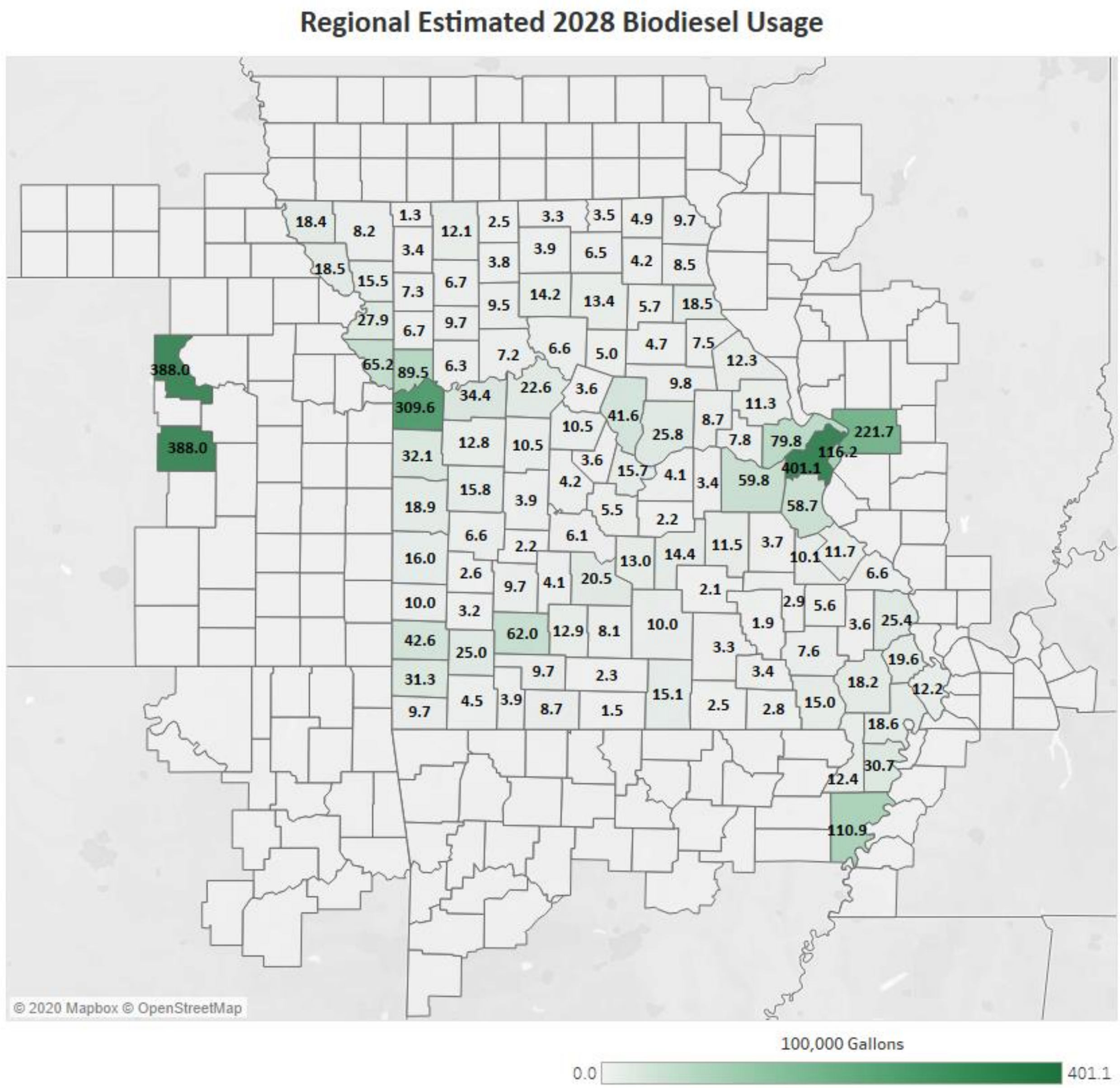


Figure 49, Regional Estimated 2028 Biodiesel Usage

Figure 50 shows the biodiesel production capacity in the Regional Biodiesel Production Model to satisfy biodiesel demand in Missouri under scenarios 1 and 2.

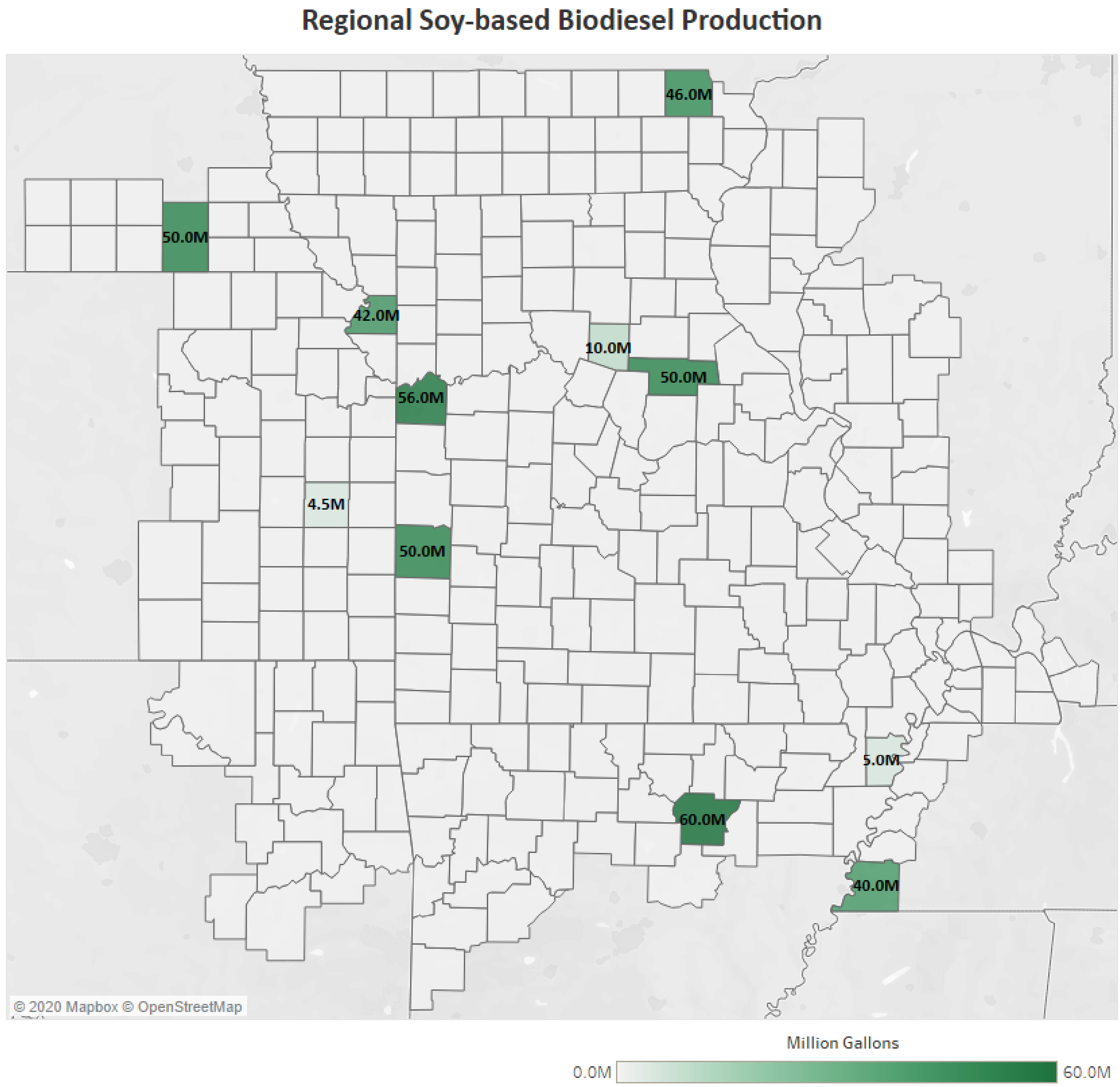


Figure 50, Regional Soy-based Biodiesel Production

Figure 51 shows the available biodiesel production capacity in the Regional Biodiesel Production Model to satisfy biodiesel demand in Missouri under scenarios 1 and 2. Production capacities in counties in CRDs abutting Missouri are estimates of "unused" capacity assuming those plants are operating at the national average capacity in 2019 and with 2028 capacity utilization rising by 1% annually, compounded monthly.

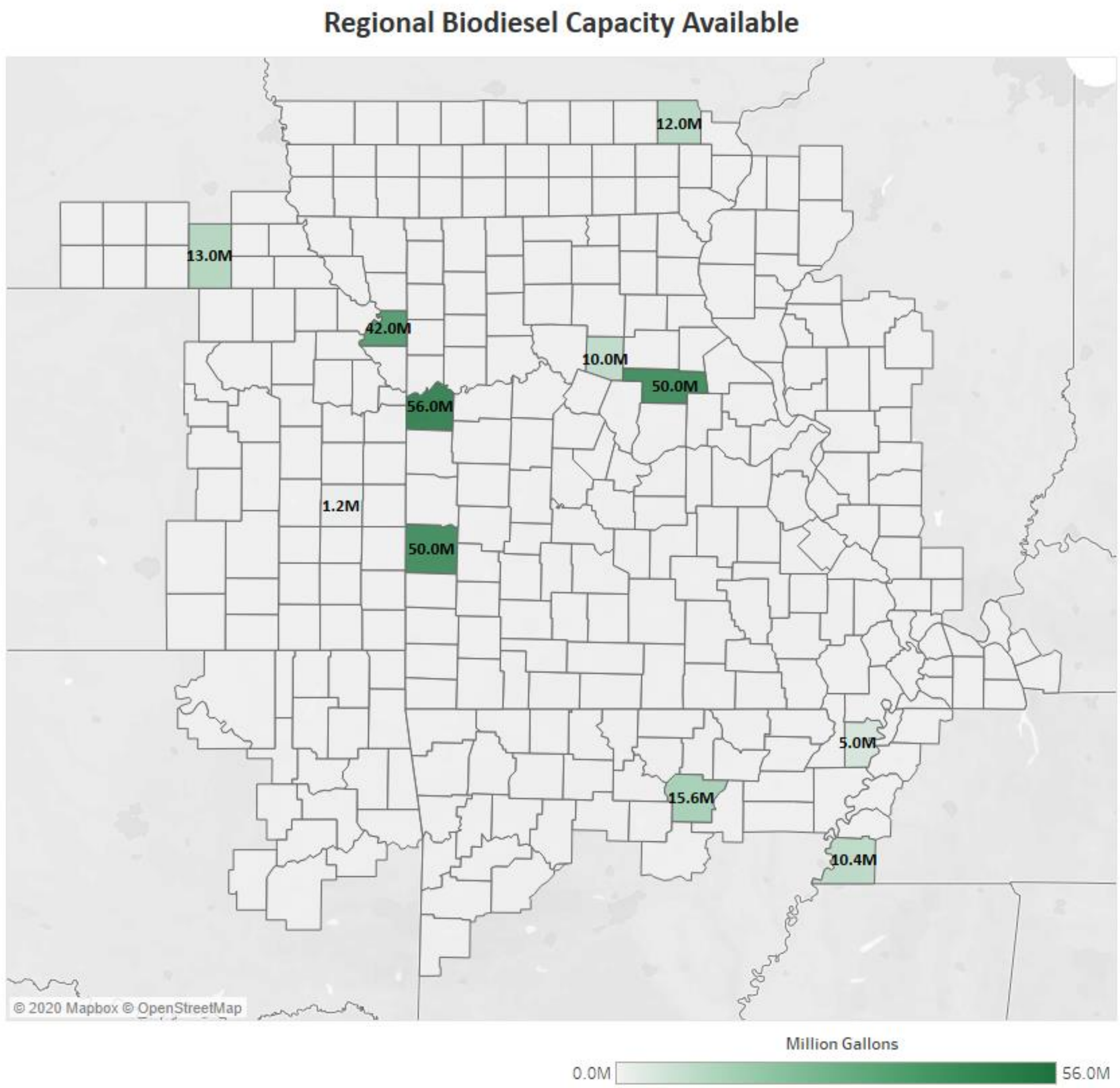


Figure 51, Regional Biodiesel Capacity Available

Figure 52 shows the estimated amounts of soybean oil that would be needed to produce biodiesel in 2028.

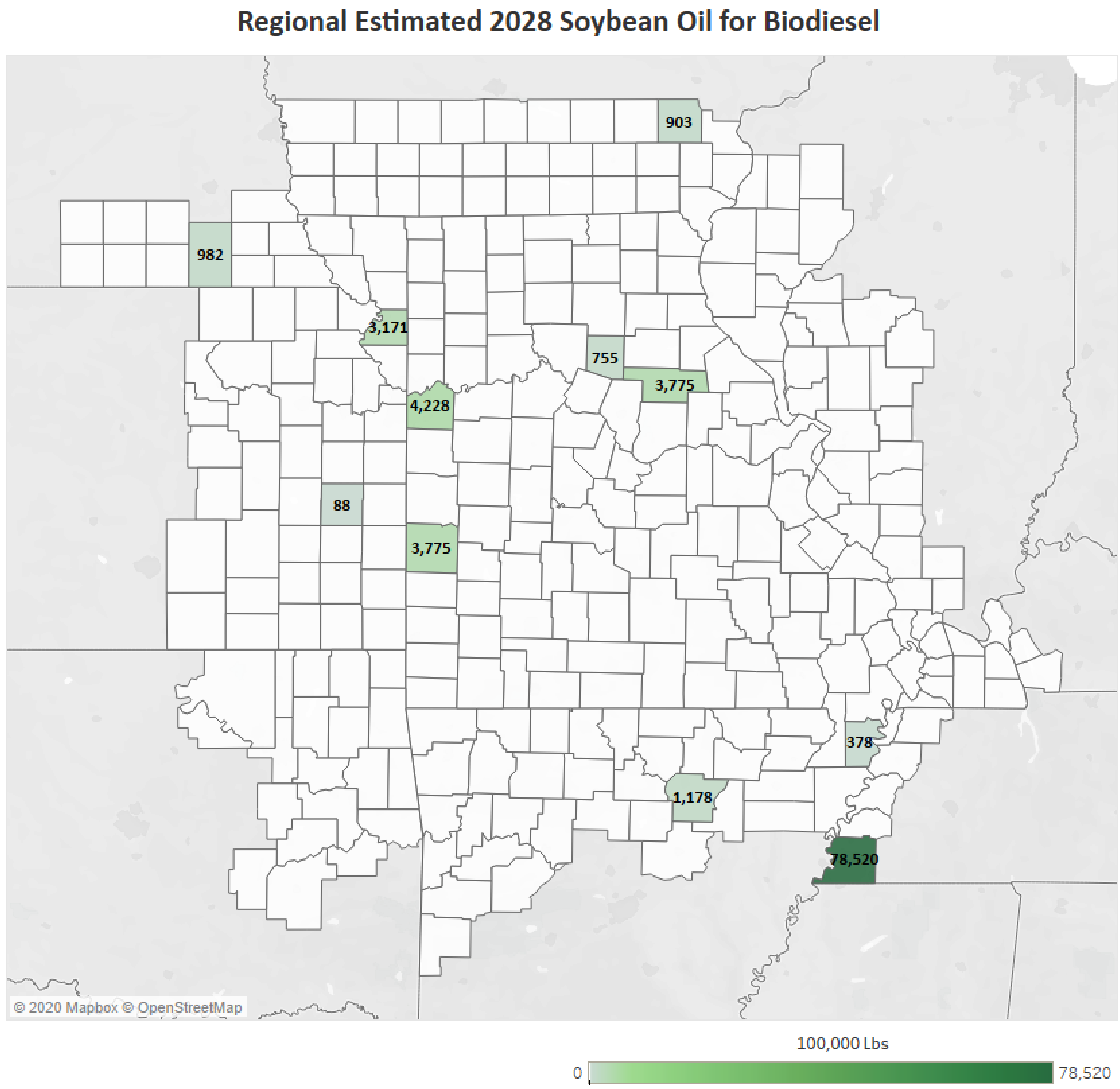


Figure 52, Regional Estimated 2028 Soybean Oil for Biodiesel

Figure 53 shows the estimated soybean oil supply/deficit counties for soy-based biodiesel production in 2028.

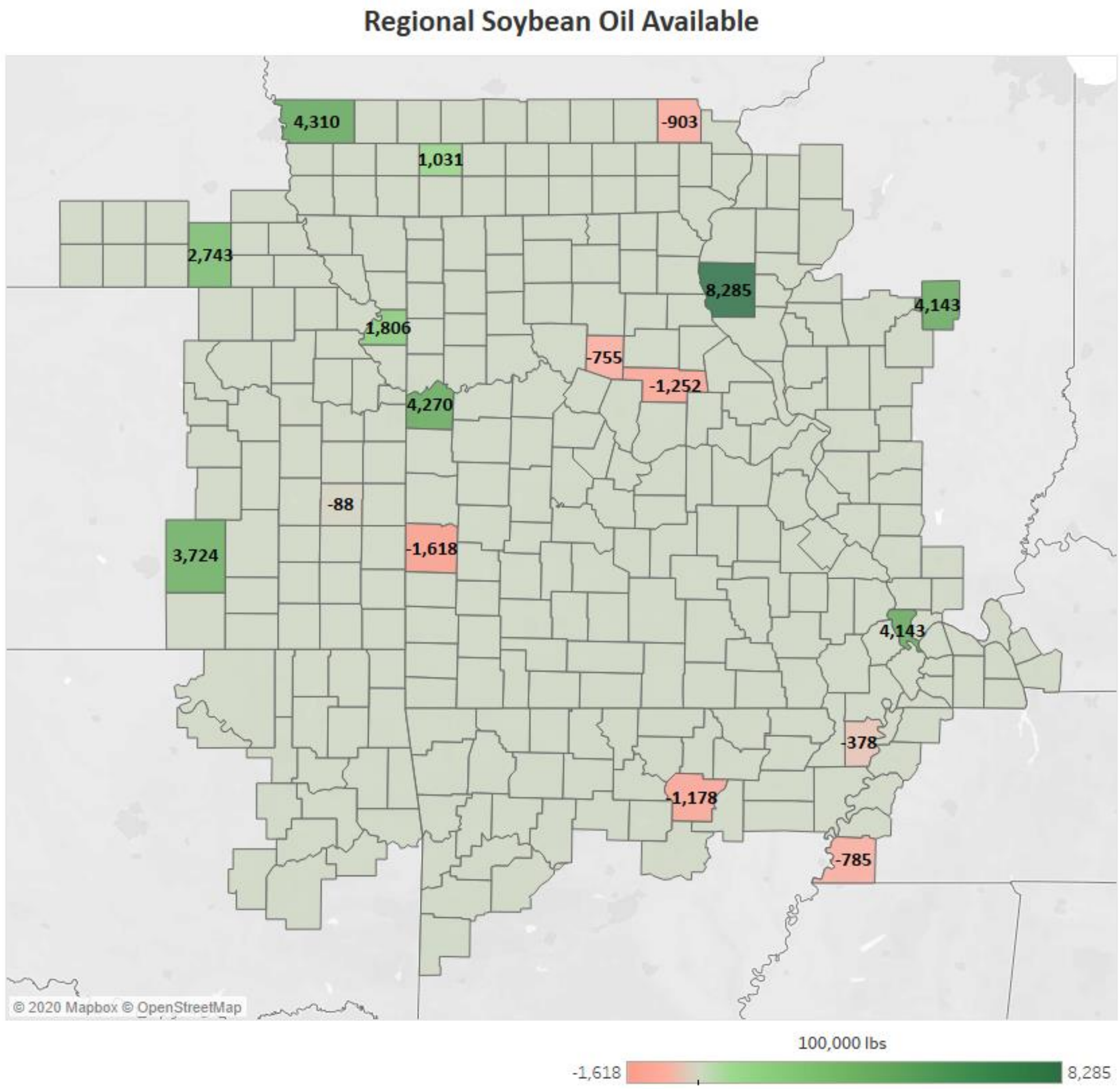


Figure 53, Regional Soybean Oil Available

Figure 54 shows the soybean crush capacity (million bushels) within Missouri and the surrounding CRDs. Total soybean crush capacity in the 4 Missouri plants and the plants in abutting CRDs (plus Macon Co., IL) is 531 million bushels.

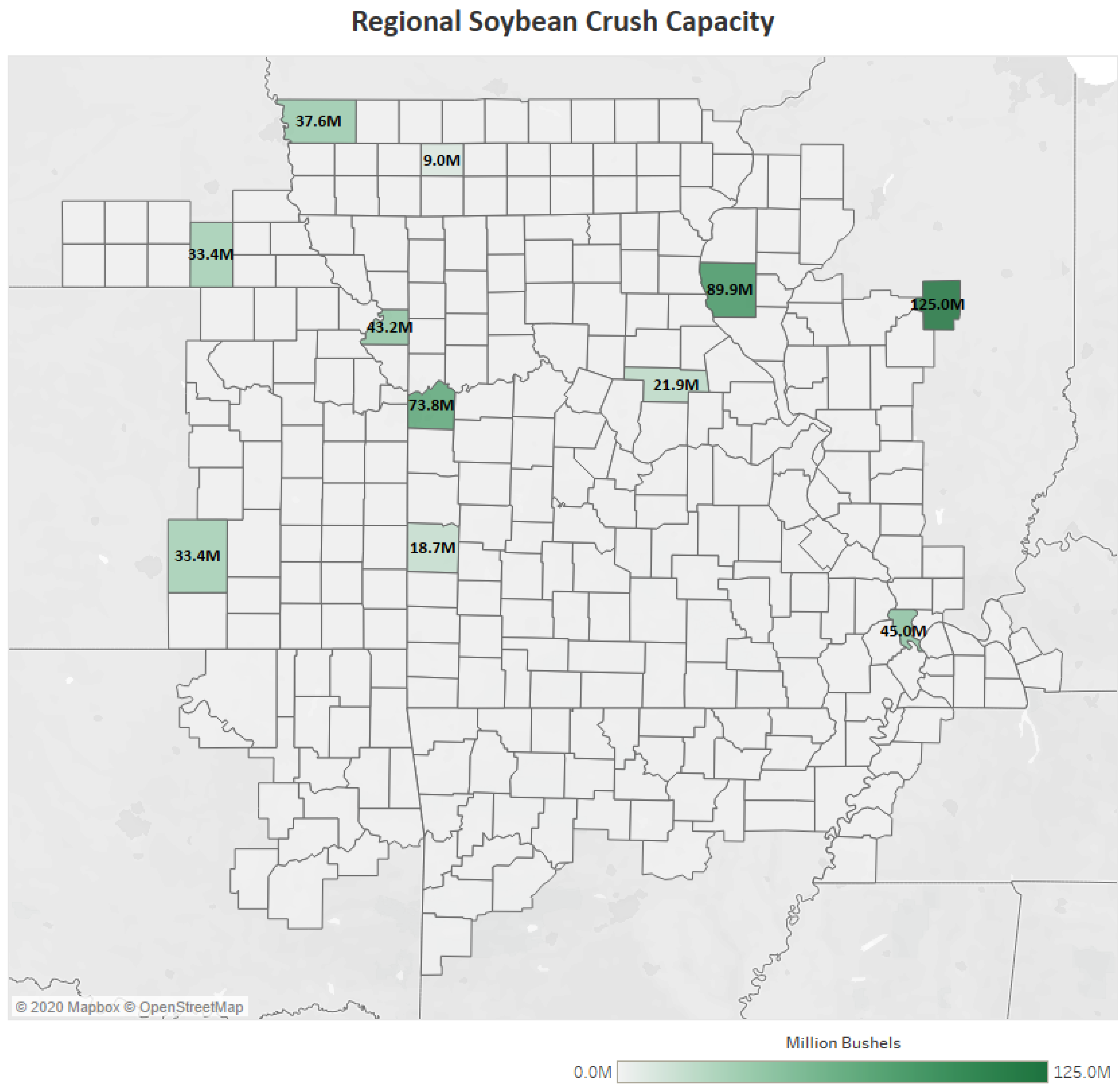


Figure 54, Regional Soybean Crush Capacity

Dynamic Flow for Missouri /Regional Model

Higher biodiesel blends will have impacts on the number of soybean processors if the demand for soybean oil as a feedstock for biodiesel exceeds the production of soybean oil from available soybean crush plants. In 2019, the biodiesel consumed in Missouri required 557.9 million pounds of soybean oil for biodiesel production. There are 12 soybean crush plants in the study area that includes Missouri, the immediately surrounding CRDs and Macon County, Illinois that have a combined soybean processing capacity of 564.2 million bushels of soybeans. These plants have the capacity to produce a total of 4,752 million pounds of soybean oil on an annual basis. Thus, the production of biodiesel consumed in Missouri uses about 10% of the soybean oil produced within the study region. The soybean processing plants within Missouri have the capacity to produce 2,200 million pounds of soybean oil. In 2019, biodiesel used in Missouri required 25% of the soybean oil produced in Missouri.

In 2028, it is projected that biodiesel consumption in Missouri would require 1,792 million pounds of soybean oil for production of the biodiesel. If no new plants were built in Missouri, biodiesel production for use in Missouri would use 81.5% of the soybean oil produced in Missouri soybean crush plants. On a regional basis, the biodiesel used in Missouri would use 32% of soybean oil production.

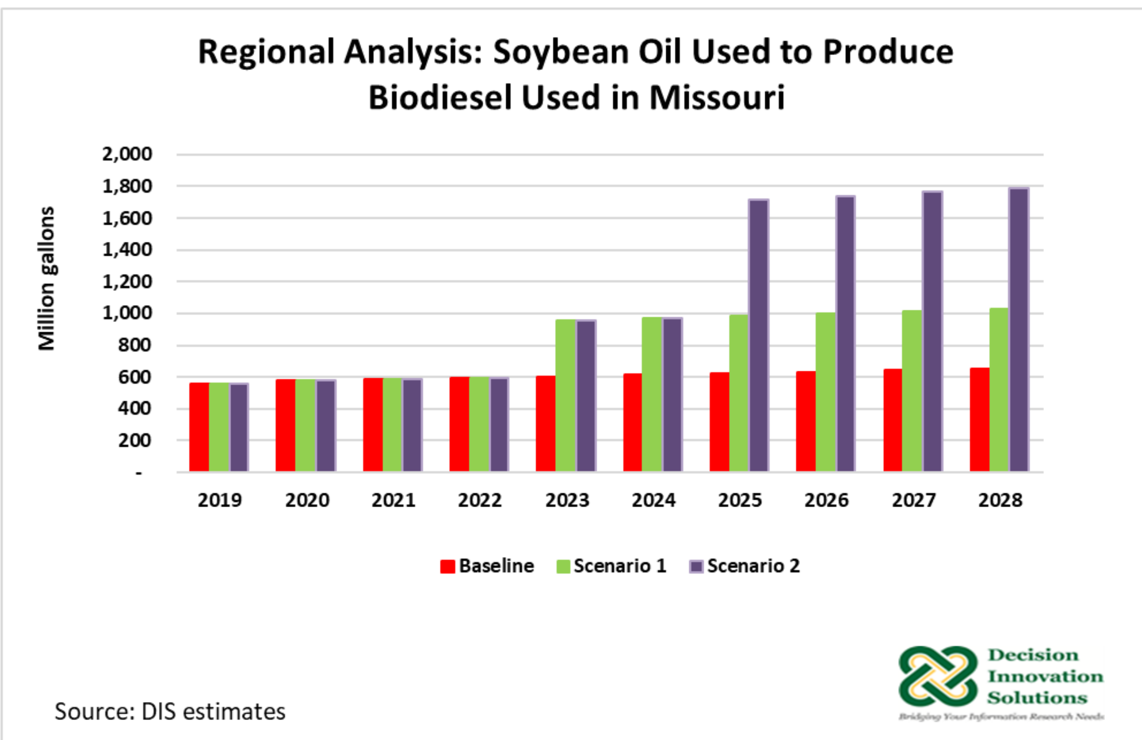


Figure 55, Regional Analysis: Soybean Oil Used to Produce Biodiesel Used in Missouri

Soybean oil is used primarily as a food-grade vegetable oil (frying, and as an ingredient in food products). According to USDA, about 6.96% of U.S. soybean oil production will be exported during the 2019-20 marketing year. Nationally, 61% of soybean oil is used for food, feed and industrial (non-biodiesel) uses and 35% for biodiesel. In the short-run, increased use of soybean oil for biodiesel that is used in Missouri is likely to come from shifts in both domestic marketing and export patterns. U.S. domestic food use of soybean oil has been declining in recent years and if that trend continues there likely will be some capacity to fill the new demand for soybean oil for biodiesel by re-allocation from other markets.

In the long-run, it is quite possible that this new demand for soybean oil would require more soybeans to be processed. If the full amount of additional soybean oil that is used in Missouri biodiesel were to be satisfied by additional soybean processing, it would take approximately 107 million bushels of additional soybean crush to provide that soybean oil.

2019 Flow Analysis

Geo-spatial centroids were assigned for each of the counties in the study area. Biodiesel production and usage for each of the counties were tagged with this geo-spatial information. Production and usage of biodiesel were also subdivided into 100,000 gallon units to facilitate the supply of biodiesel and claiming of biodiesel as the SAS loop matches demand with its closest available supply.

In 2019, Missouri soy-based biodiesel plants produced an estimated 170 million gallons of biodiesel. Approximately 74 million gallons were used within Missouri and 96 million gallons were shipped out of state. Figure 56 shows the biodiesel consumption in each county in Missouri and modeled out-of-state shipments to 4 points representing movement of biodiesel east, west and south from Missouri. The color coding in the map indicates the Missouri soy-based biodiesel plant that is the likely supply point for each of the demand points and the height of the bar represents the relative amount of biodiesel secured from each production facility.

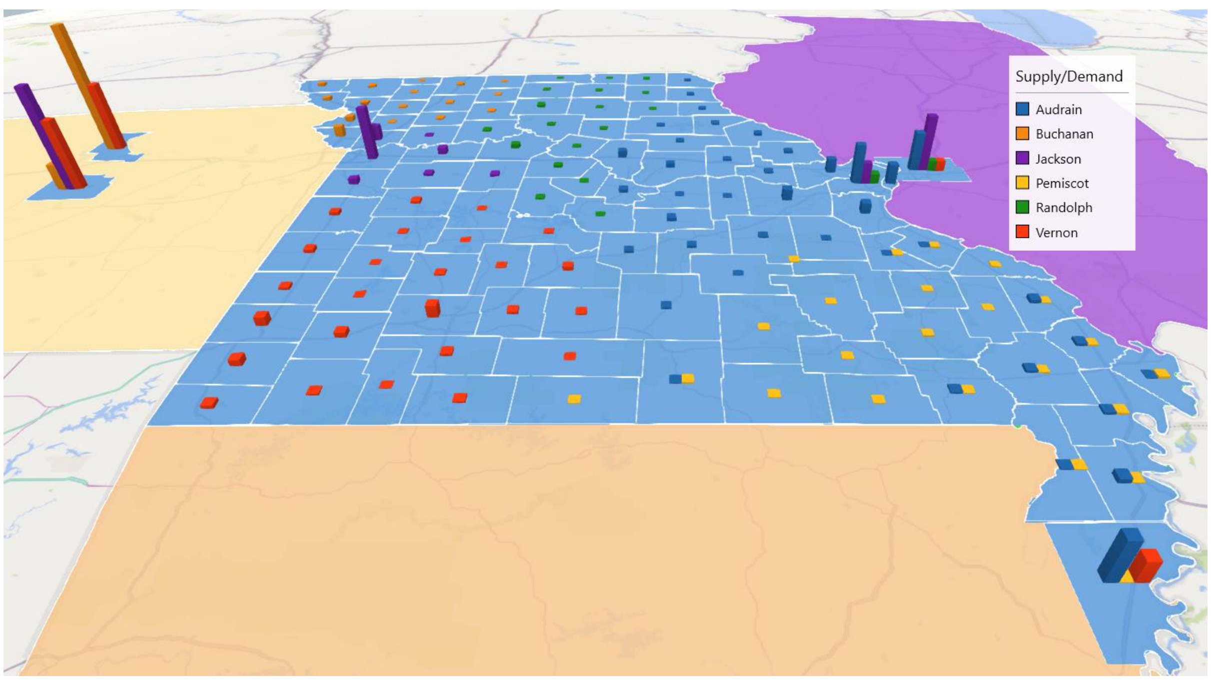


Figure 56 Missouri 2019 Biodiesel Flow Map

Note: The data table for Figure 56 is in Appendix D, Table 20

Within Missouri, biodiesel from Audrain county goes to northeast and east-central Missouri. Biodiesel from Buchanan county supplies northwest Missouri. Jackson county biodiesel is used in the greater Kansas City area and neighboring counties. Pemiscot county biodiesel partially supplies southeastern Missouri and the Bootheel area. Randolph county biodiesel supplies central and northcentral Missouri. Vernon county supplies southwestern Missouri.

Out-of-state shipments to western destinations are supplied by biodiesel from Buchanan (39%), Jackson (26%) and Vernon (35%) counties. Biodiesel shipments to southern destinations are supplied by Audrain (65%), Pemiscot (2%) and Vernon (33%) counties. Biodiesel shipments to eastern out-of-state destinations and the St. Louis area are supplied by Audrain (51%), Jackson (35%), Randolph (9%) and Vernon (5%) counties.

2028 Scenario 2B Regional Flow Analysis With 50 Million Gallons in Scott Co., MO

The 2028 flow analysis adds the unused capacity from biodiesel plants in the abutting CRDs, 38 million gallons of supply from outside of the region that is used to partially satisfy western out-of-state demand and 50 million gallons of supply in Scott County, Missouri. With the addition of 50 million gallons of biodiesel production in Scott County, Missouri and substantially increased use in the Kansas City and St. Louis metropolitan areas, the flow patterns change. Much more of the Buchanan and Jackson county biodiesel production is used within the Kansas City and St. Joseph metropolitan areas. Scott county biodiesel would satisfy biodiesel needs in a greater portion of the Ozarks plus become a significant supply point for the St. Louis metropolitan area (35%) and for eastern out-of-state shipments (44%). Southern out-of-state shipments would likely be satisfied by the Shelby County, TN biodiesel facility (92%). And, western out-of-state shipments would be satisfied by shipments from Kansas biodiesel facilities (46%), Buchanan Co., MO (16%, Gage Co., NE (14%), Independence Co., AR (4%), and Vernon Co., MO (20%).

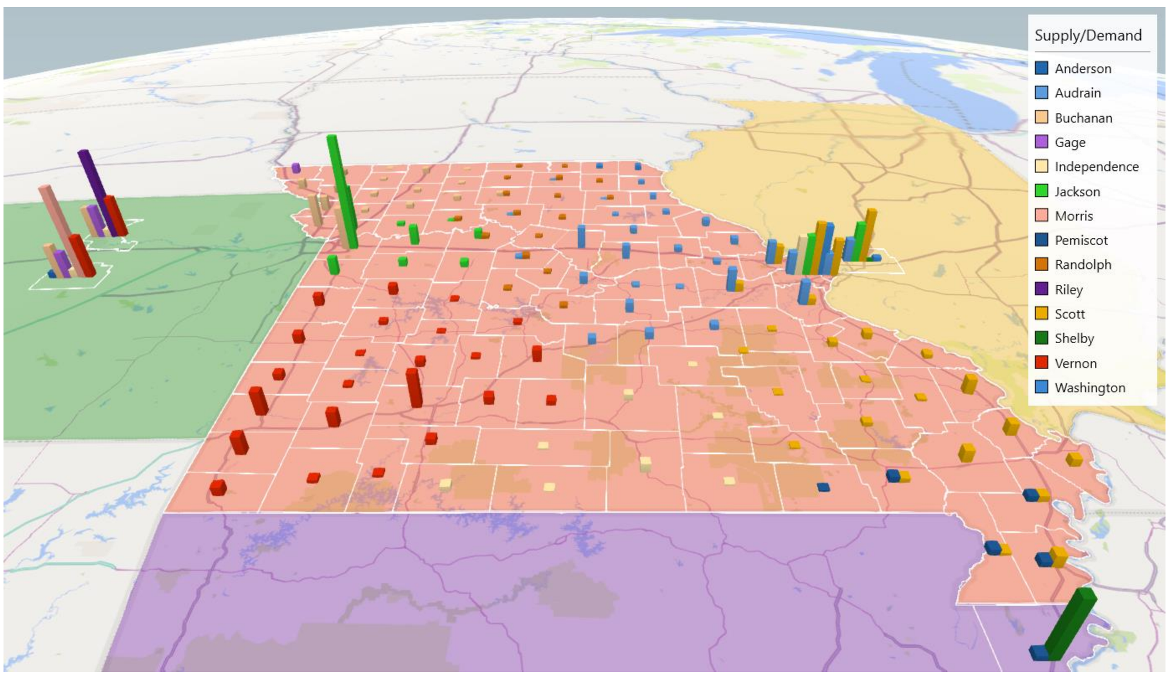


Figure 57 Regional Biodiesel Flow Analysis 2028, with Scott Co., MO Biodiesel Plant

Note: The Data Table for Figure 57 is in Appendix D Table 21

SBO Flow Analysis 2028, Existing Regional Biodiesel Plants

In 2028, it is estimated that all existing biodiesel production plants will be operating at capacity. Figure 58 shows the supply sourcing by biodiesel production demand point for the regional biodiesel production facilities. In Missouri, Audrain County will secure its soybean oil from Audrain county and from Adams County, IL. Buchanan County has enough soybean oil production to secure all its biodiesel feedstock from its own plant. The same hold for Jackson

County, MO. Pemiscot County would likely receive its soybean oil from Alexander County, IL. Randolph County would be supplied soybean oil from Audrain County. Vernon County would secure soybean oil from Vernon County and from Jackson County. Independence County, AR would obtain soybean oil feedstock from Alexander County, IL and Adams County, IL.

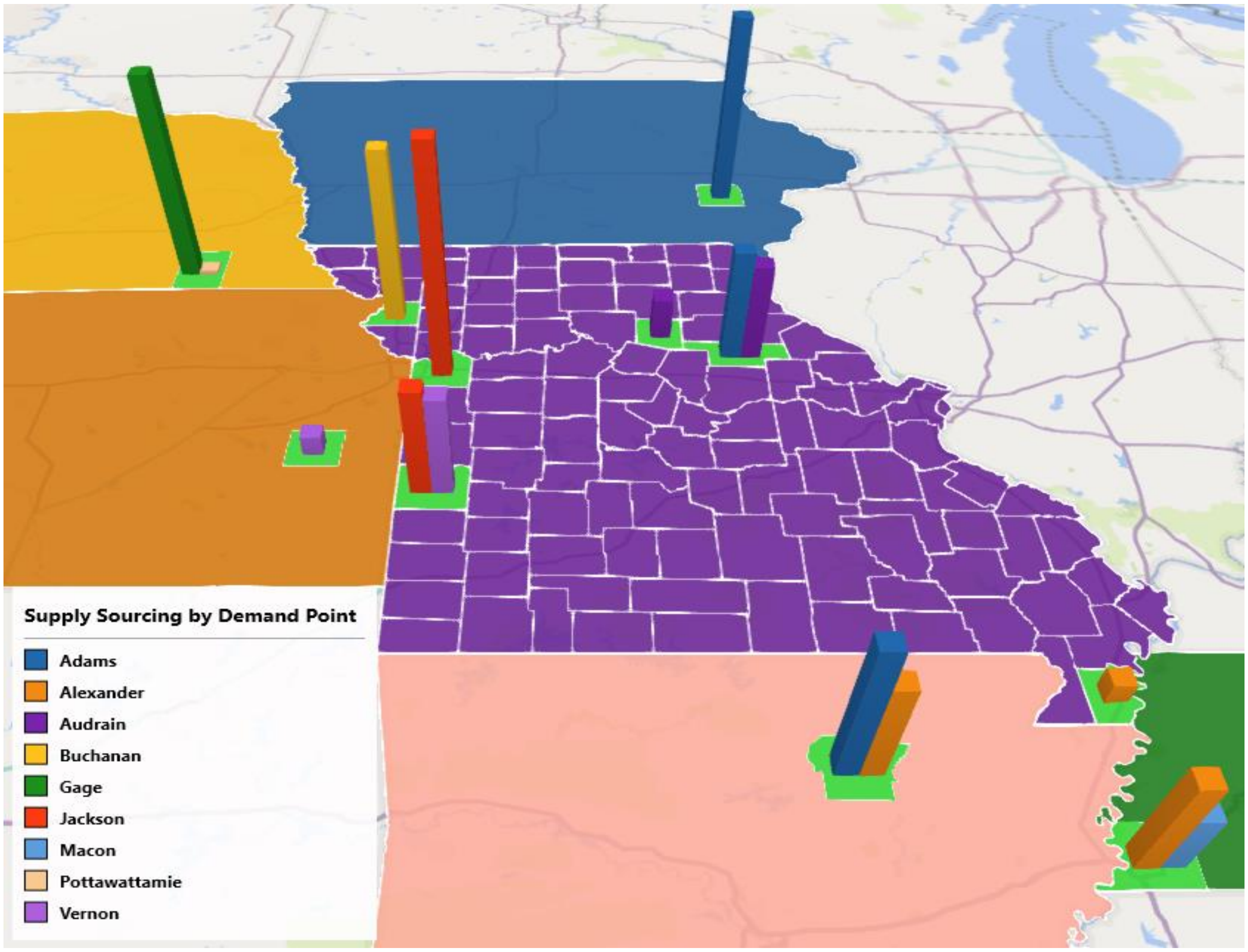


Figure 58 Soybean Oil Flow 2028 from Regional Processors to Biodiesel Plants, 2028, Existing Biodiesel Plants

Table 11 2028 Biodiesel Supply Sourcing by Demand Point for Figure 58

2028 Biodiesel Supply Sourcing by Demand Point for Figure 58 (100,000 Gallon Units)									
	Soybean Oil Supply Points								
	Illinois			Iowa	Missouri				Nebraska
Biodiesel Plants	**Adams**	**Alexander**	**Macon**	**Pottawattamie**	**Audrain**	**Buchanan**	**Jackson**	**Vernon**	**Gage**
Independence, AR	265	188							
Washington, IA	347								
Anderson, KS								34	
Audrain, MO	202				176				
Buchanan, MO						317			
Jackson, MO							423		
Pemiscot, MO		38							
Randolph, MO					76				
Vernon, MO							196	182	
Gage, NE				6					372
Shelby, TN		188	114						

Neighboring States Flow Analysis

Neighboring States Crush Capacity and Soybean Oil Production

There are 41 soybean crush facilities in Missouri and the surrounding, neighboring states with a total soybean crush capacity estimated at 1.217 billion bushels per year. These soybean crush facilities, at capacity operations, have the capability of producing 9.194 billion pounds of soybean oil.

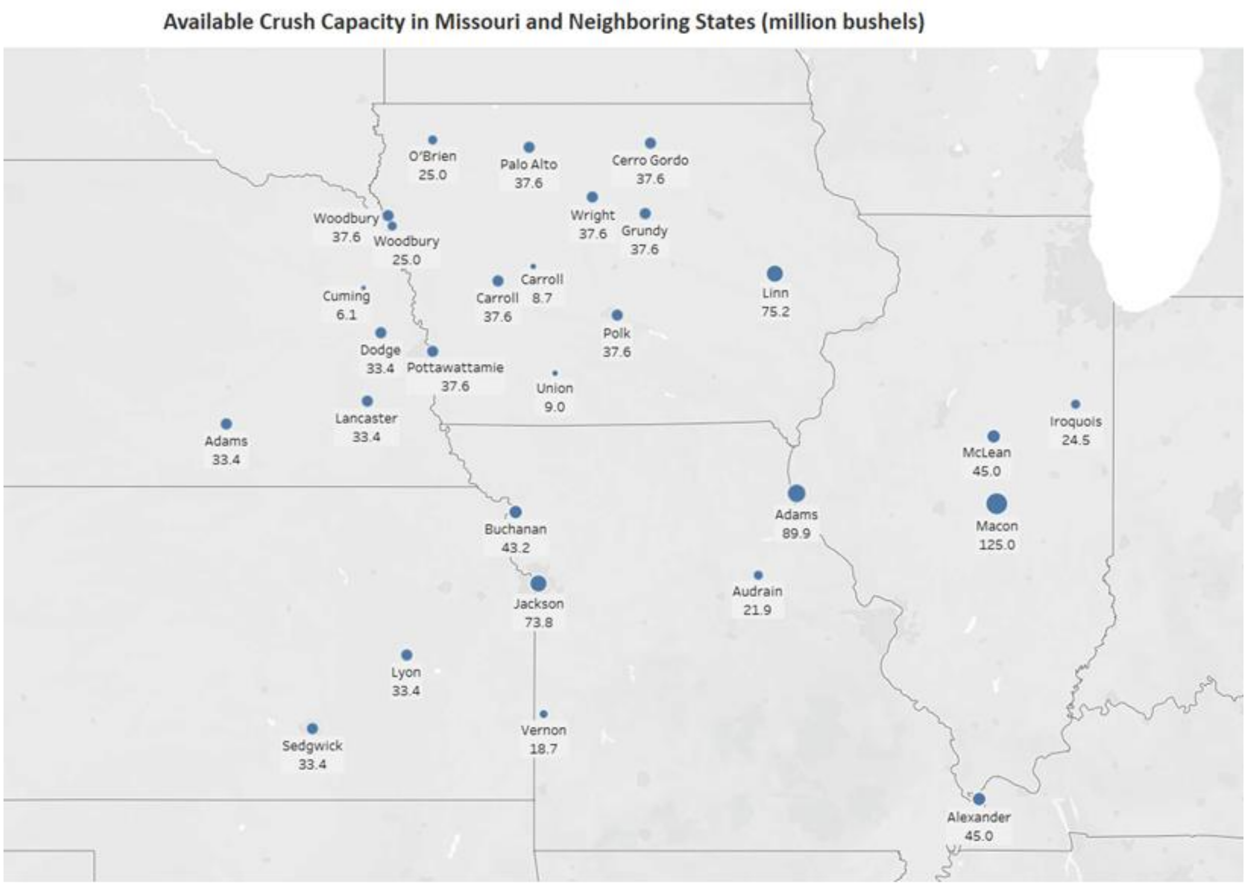


Figure 59 Soybean Crush Capacity in Missouri and Neighboring States

2028 Scenario 2B Flow Analysis, Existing Available Capacity in Neighboring States

With expanded biodiesel consumption within Missouri in 2028 and trendline increases in out-of-state use, total biodiesel use in Missouri rises to 237 million gallons and out-of-state shipments rise to 111 million gallons for a total study area demand of 348.6 million gallons. In 2028, without new biodiesel plant construction it is estimated that there will be 213 million gallons of biodiesel production within Missouri and 47 million gallons of unused biodiesel production capacity in the 8 biodiesel plants in abutting CRDs. The total available biodiesel capacity in Missouri and the abutting CRDs (260 million gallons) would leave 89 million gallons of demand under Scenario 2B unmet. To address this deficit in available production, the supply area is expanded to the Neighboring states case in which there is 444 million gallons available.

The flow analysis shows that soybean-based biodiesel would use all the capacity of Missouri's biodiesel plants and would be pulled from two biodiesel plants in Arkansas, three in Illinois, six in Iowa, two in Kansas, one in Kentucky, two in Nebraska, and one in Tennessee.

8-State Existing Biodiesel Flow by Demand Point Analysis for Missouri Scenario 2B, 2028

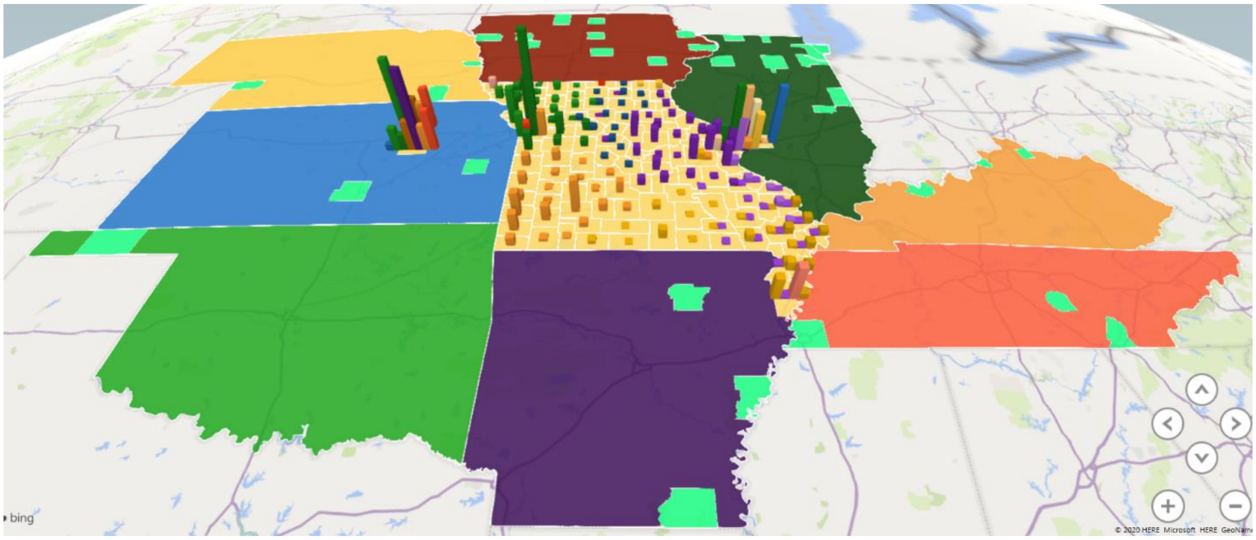


Figure 60 8-State Existing Biodiesel Flow by Demand Point Flow Analysis for Missouri Scenario 2B, 2028

Note: The data table for Figure 60 is in Appendix D Table 22

8-State Soybean Oil Flow from Existing Soybean Crush Plants to Existing Biodiesel Plants, Scenario 2B, 2028

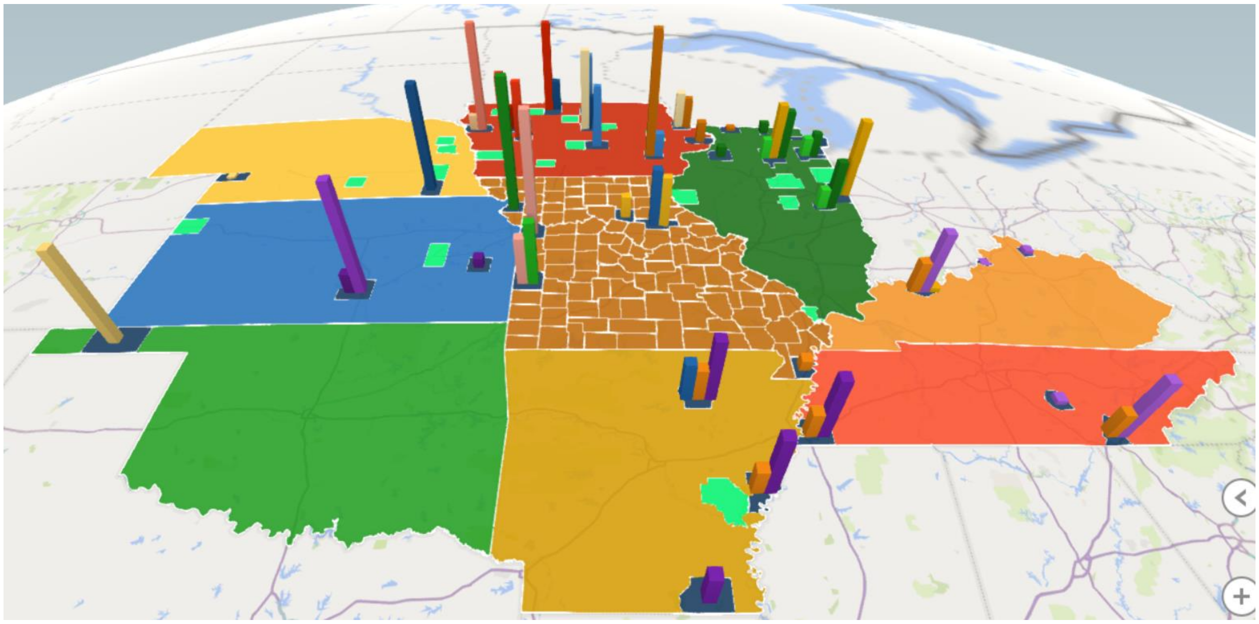


Figure 61 8-State Soybean Oil Flow from Existing Soybean Crush Plants to Existing Biodiesel Plants, Scenario 2B, 2028

Table 12 8-State Soybean Oil Flow from Existing Soybean Crush Plants to Existing Biodiesel Plants, Scenario 2B, 2028 Data Table

8-State Soybean Oil Flow from Existing Soybean Crush lants to Existing Biodiesel Plants, Scenario 2B, 2028																										
		Soybean Oil Supply Plants																								
	Arkansas	Illinois					Iowa									Kansas			Kentucky	Missouri				Nebraska		
Biodiesel Plants	Arkansas	Adams	Alexander	Iroquois	Macon	McLean	Carroll	Cerro Gordo	Grundy	Linn	Polk	Pottawattamie	Palo Alto	Woodbury	Wright	Lyon	Sedgwick	Sherman	Daviess	Audrain	Buchanan	Jackson	Vernon	Cuming	Lancaster	Grand Total
Ashley, AR	113																									113
Independence, AR	214	131	108																							453
Phillips, AR	214		88																							302
Boone, IL						38																				38
Cook, IL				1																						1
Douglas, IL				70		172																				242
Henry, IL						38																				38
LaSalle, IL				71	202	180																				453
Stephenson, IL										15																15
Vermilion, IL				70	270																					340
Will, IL				70		89																				159
Carroll, IA							216						11													227
Cerro Gordo, IA								227																		227
Clinton, IA										76																76
Dubuque, IA									135	114																249
Hardin, IA									298						125											423
Jasper, IA											227															227
Kossuth, IA													338		115											453
Sac, IA							217					3	84	36												340
Washington, IA										456	88															544
Woodbury, IA														397										56		453
Anderson, KS																34										34
Sedgwick, KS																69	384									453
Daviess, KY			108		17														215							340
Oldham, KY																			1							1
Pendleton, KY																			15							15
Audrain, MO		202																		176						378
Buchanan, MO																					454					454
Jackson, MO																						423				423
Pemiscot, MO			38																							38
Randolph, MO																				76						76
Vernon, MO																						163	215			378
Gage, NE																									378	378
Perkins, NE																		8								8
Texas, OK																		340								340
Hamilton, TN			88																214							302
Shelby, TN	215		87																							302
Warren, TN																			15							15
Grand Total	756	333	517	282	489	517	433	227	433	661	315	3	433	433	240	103	384	348	460	252	454	586	215	56	378	9,308

The 39 soybean-based biodiesel plants would source soybean oil from the soybean crush plants in 25 counties in the 8-state area. Many biodiesel plants would need to secure soybean oil from multiple soybean crush plants.

8-State (with Scott County, MO plant) Biodiesel Flow Analysis for Missouri Scenario 2B, 2028

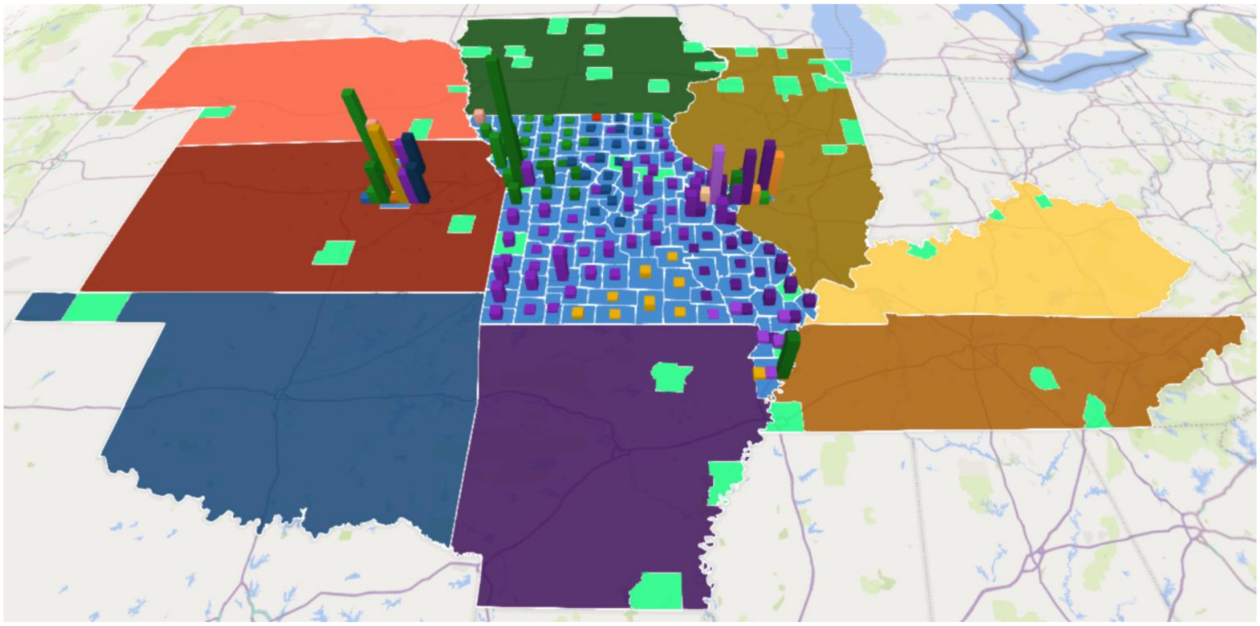


Figure 62 8-State (with Scott County, MO plant) Biodiesel Flow Analysis for Missouri Scenario 2B, 2028

Note: The data table for Figure 62 is in Appendix D Table 23

With the addition of a 50 million gallon per year soybean-based biodiesel facility in Scott County, MO, the supply and flow of biodiesel changes. While there would still be full utilization of the biodiesel production capacity of Missouri's biodiesel plants, there would be less dependence on biodiesel supplies from Arkansas (14.6 million gallons less), Illinois (11.3 million gallons less), Iowa (16.6 million less), and Nebraska (7.5 million gallons less).

8-State Soybean Oil Flow from Existing Soybean Crush Plants to Biodiesel Plants with Scott County, MO Plant, Scenario 2B, 2028

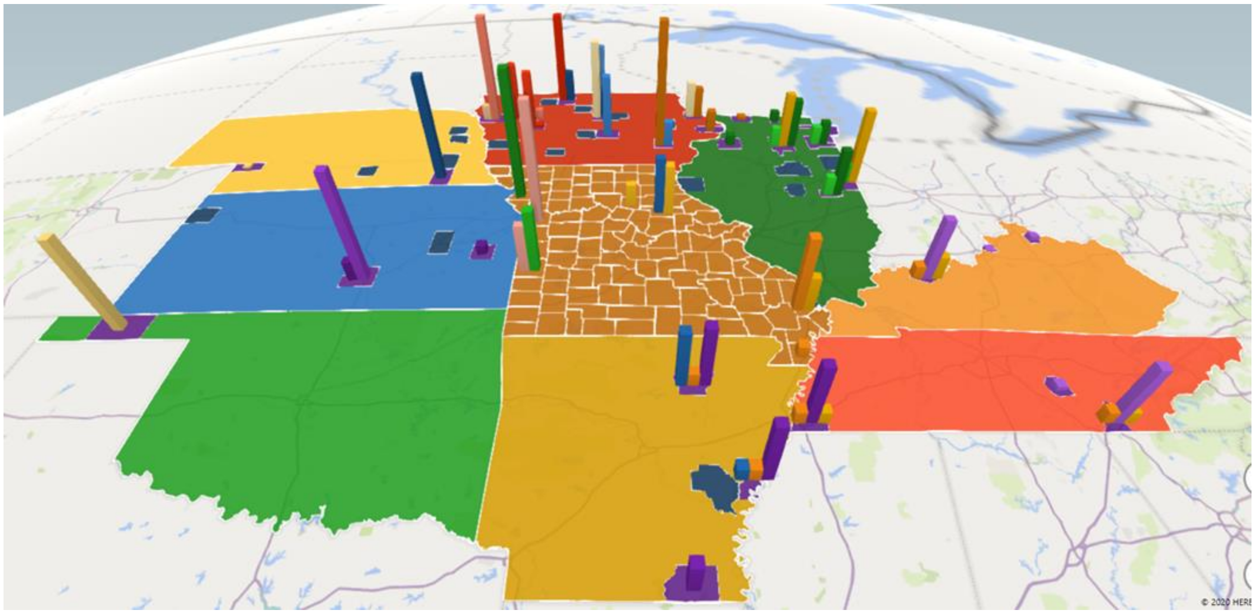


Figure 63 8-State Soybean Oil Flow from Existing Soybean Crush Plants to Biodiesel PLants with Scott County, MO Plant, Scenario 2B, 2028

Table 13 8-State Soybean Oil Flow from Existing Soybean Crush Plants to Biodiesel Plants with Scott County, MO Plant, Scenario 2B, 2028, Data Table

8-State Soybean Oil Flow from Existing Soybean Crush Plants to Biodiesel Plants with Scott County, MO Plant, Scenario 2B, 2028 Data Table																									
	Soybean Oil Supply Plants																								
	Arkansas	Illinois					Iowa									Kansas			Kentucky	Missouri				Nebraska		
Biodiesel Plants	Arkansas	Adams	Alexander	Iroquois	Macon	McLean	Carroll	Cerro Gordo	Grundy	Linn	Palo Alto	Polk	Pottawattamie	Woodbury	Wright	Lyon	Sedgwick	Sherman	Daviess	Audrain	Buchanan	Jackson	Vernon	Cuming	Lancaster	Grand Total
Ashley, AR	113																									113
Independence, AR	214	195	44																							453
Phillips, AR	214	44	44																							302
Boone, IL						38																				38
Cook, IL				1																						1
Douglas, IL				70		172																				242
Henry, IL						38																				38
LaSalle, IL				70	203	180																				453
Stephenson, IL										15																15
Vermilion, IL				71	269																					340
Will, IL				70		89																				159
Carroll, IA							217				10															227
Cerro Gordo, IA								227																		227
Clinton, IA										76																76
Dubuque, IA									135	114																249
Hardin, IA									298						125											423
Jasper, IA												227														227
Kossuth, IA											338				115											453
Sac, IA							216				85		3	36												340
Washington, IA										456		88														544
Woodbury, IA														397										56		453
Anderson, KS																34										34
Sedgwick, KS																69	384									453
Daviess, KY			44		81														215							340
Oldham, KY																			1							1
Pendleton, KY																			15							15
Audrain, MO		202																		176						378
Buchanan, MO																					454					454
Jackson, MO																						423				423
Pemiscot, MO			38																							38
Randolph, MO																				76						76
Scott, MO			259		119																					378
Vernon, MO																						163	215			378
Gage, NE																									378	378
Perkins, NE																		8								8
Texas, OK																		340								340
Hamilton, TN			44		44														214							302
Shelby, TN	215		44		43																					302
Warren, TN																			15							15
Grand Total	756	441	517	282	759	517	433	227	433	661	433	315	3	433	240	103	384	348	460	252	454	586	215	56	378	9,686

Transportation Cost Impact

Biodiesel and Diesel Prices

Figure 64 shows Missouri average daily retail prices for ULS diesel and biodiesel during December 7, 2019 to February 10, 2020. From the beginning of the period to the end, ULS diesel price fell 4.4% ($0.1189/gallon) while biodiesel prices declined about 4.7% ($0.1286/gallons). According to the Energy Information Administration (EIA), U.S. distillate inventories, which includes both diesel and home heating oil, showed a 4.1 million barrels month-on-month increase in January, unusual for a month in which inventories tend to fall. The increase in U.S. distillate inventories may reflect the warmer than normal U.S. winter and resulted in a decline in diesel price. This reflects how the national price trend may affect the local price trend.

Figure 65 indicates that on average, B2 was the only biodiesel mix sold at a discounted price relative to ULS diesel. The price of B2 was down $0.01/gallon compared with ULS diesel during the December 7, 2019 to February 10, 2020 period. B5 and B11 premiums over ULS diesel were almost negligible during the same period.

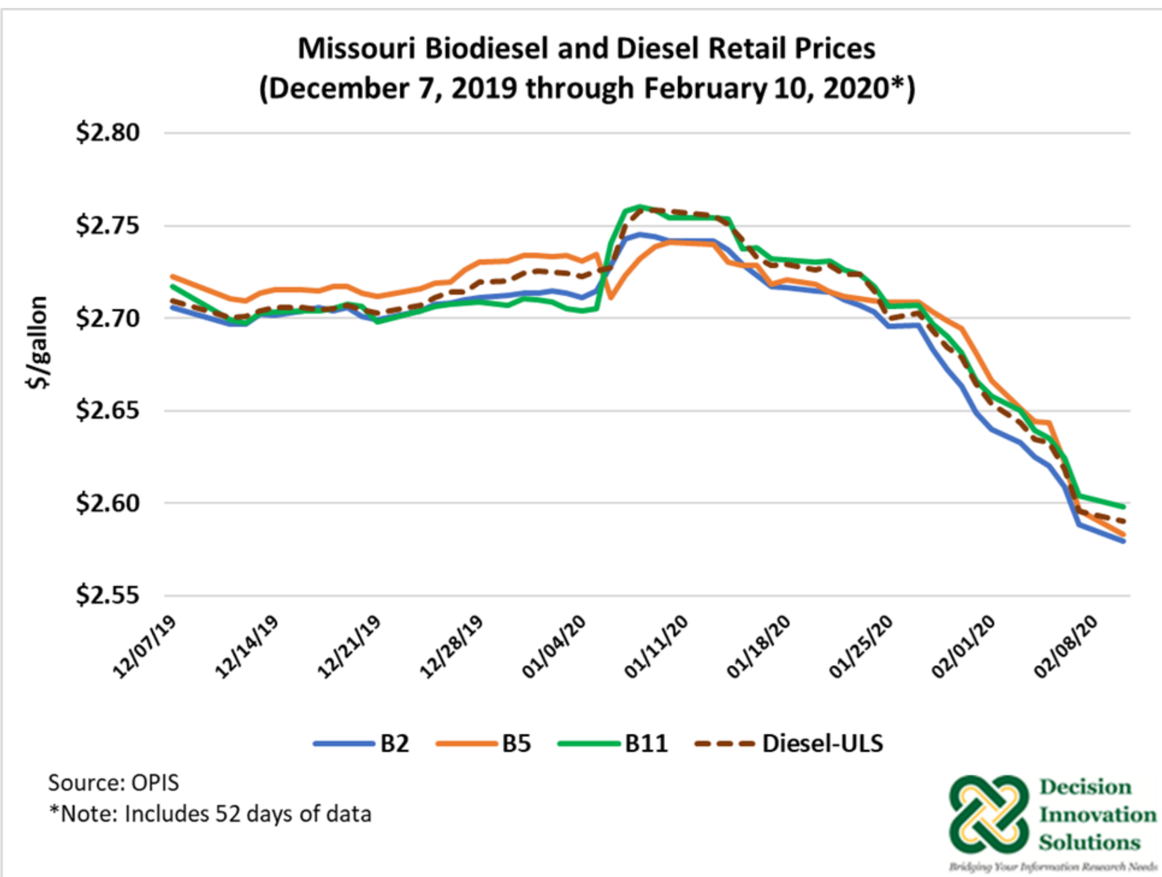


Figure 64. Missouri Biodiesel and Diesel Retail Prices (December 7, 2019 through February 10, 2020)

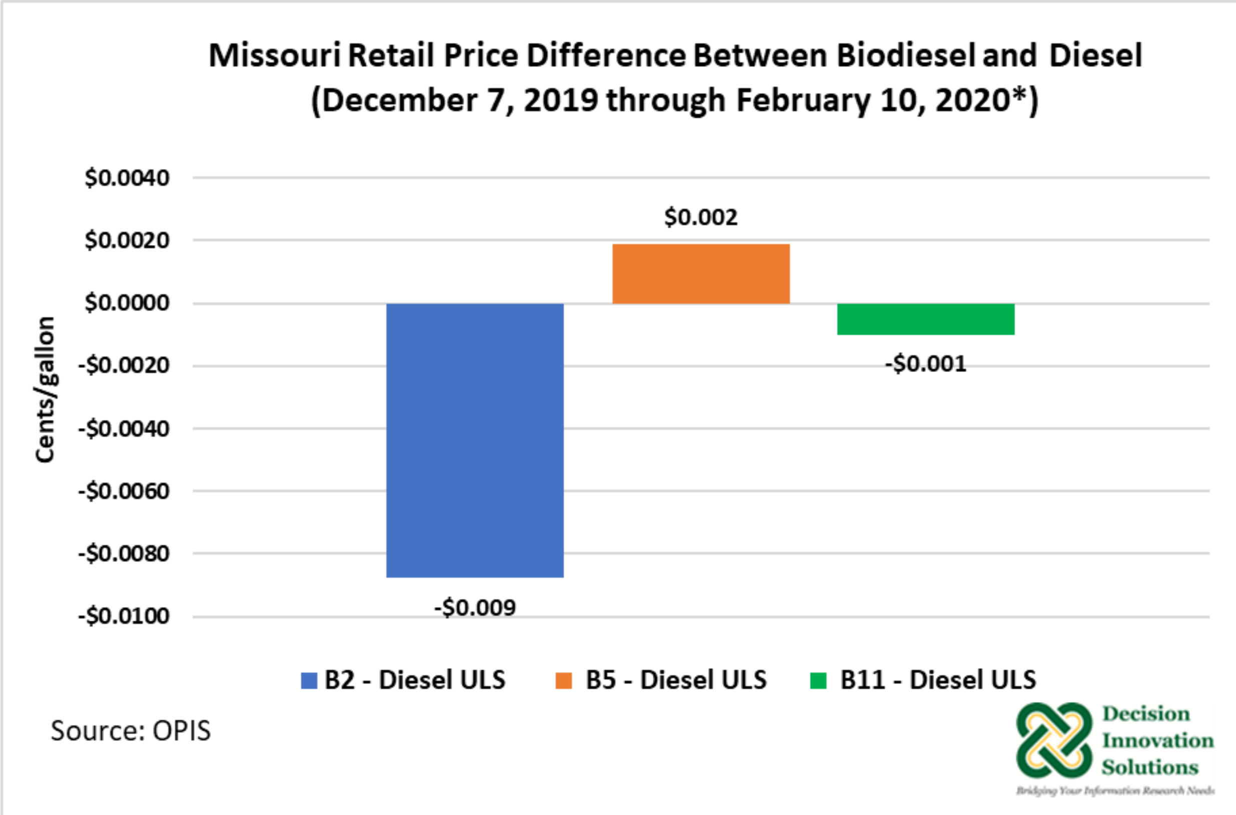


Figure 65. Missouri Retail Price Difference Between Biodiesel and Diesel (December 7, 2019 through February 10, 2020)

Figure 66 shows the relationship of monthly U.S. biodiesel (B100) and U.S. ULS diesel prices from April 2007 to December 2019. For the most part, U.S. B100 prices were above ULS diesel prices during that period. B100 premium over diesel tended to be larger during periods in which the biodiesel tax credit was in effect during the time of production (i.e., not applied retroactively), such as 2011, 2013, and 2016. On average, U.S. B100 premium over U.S. ULS diesel was $0.46/gallon during April 2007 to December 2019. The difference between biodiesel price and ULS price declines with the level of blending mix. On average the B20 premium over ULS diesel was $0.092/gallon, whereas the B5 premium was $0.023/gallon (see Figure 67).

The B5 and B20 prices were estimated as:

B5 price = ULS diesel price X 0.95 + B100 price X 0.05

B20 price= ULS diesel price X 0.80 + B100 price X 0.20

Analysis by the University of Illinois indicates there was a spike in biodiesel profitability during 2011, 2013, and 2016 that could be directly related to the race by diesel blenders to take advantage of the $1 per gallon blender tax that expired at the end of those years. This pattern depends on blenders perception as there is substantial uncertainty whether the tax credit would be reinstated or not for the next year. According to the authors, the logic behind this cycle is that blenders have a binding RFS mandate, and it is reasonable to effectively purchase biodiesel at a discount in the years that the tax credit is effective (i.e., not applied retroactively), in order to meet mandates moving forward. Note that the University of Illinois study found that the increase in profitability in 2016 was not as large as in the previous two cases. The large 2016 volume of biodiesel imports mainly from Argentina, is the most plausible explanation for the limited 2016 spike.

The biodiesel blender tax credit was reinstated retroactively from its expiration on Jan. 1, 2018, through Dec. 31, 2022. As long as the tax credit is in effect and especially if there were certainty regarding the extension of the federal tax credit beyond 2022, there would be little reason to expect significant pricing differentials between ULS and B5, B10 or B20 blends.

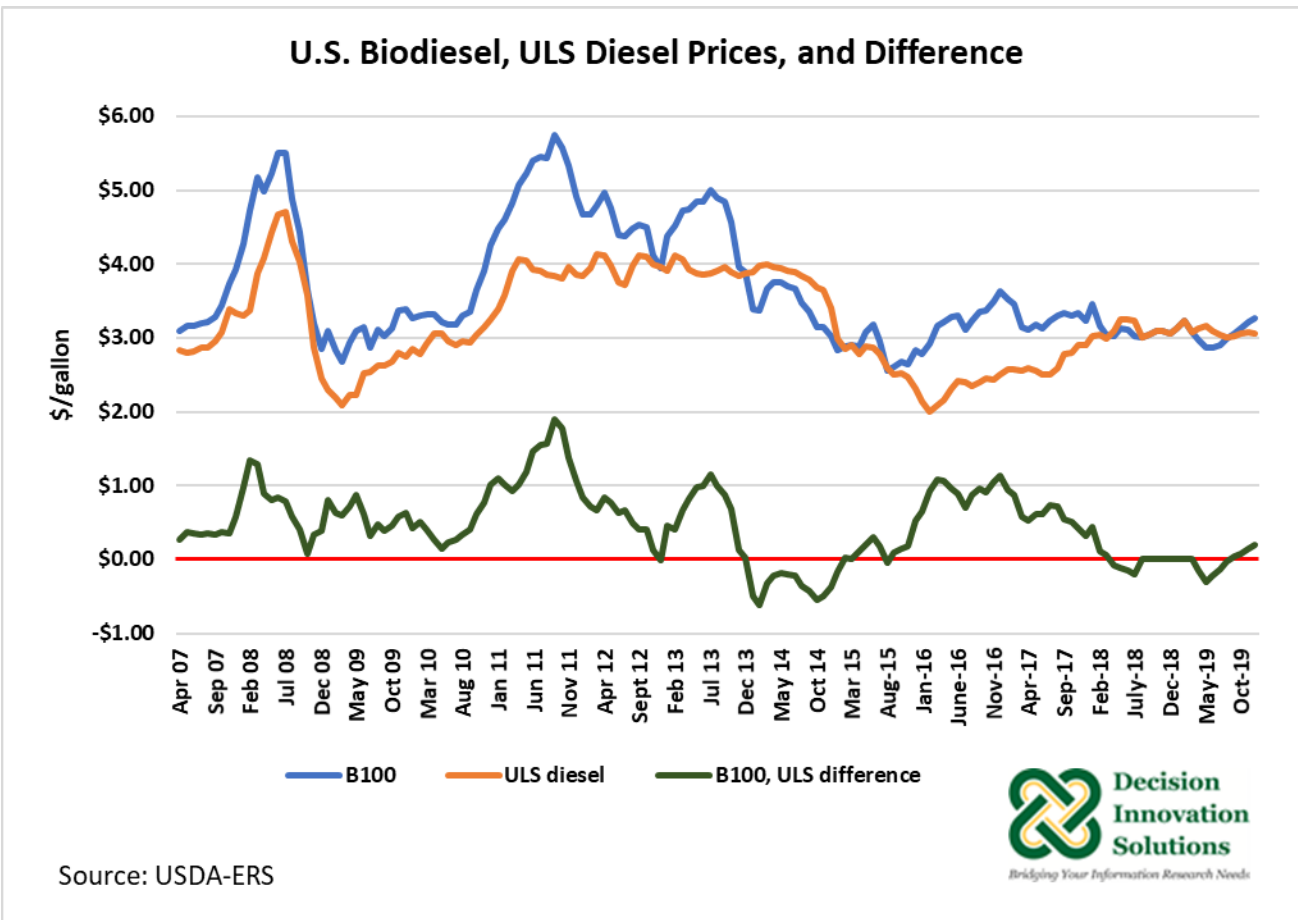


Figure 66. U.S. Biodiesel, Diesel Prices, and Difference

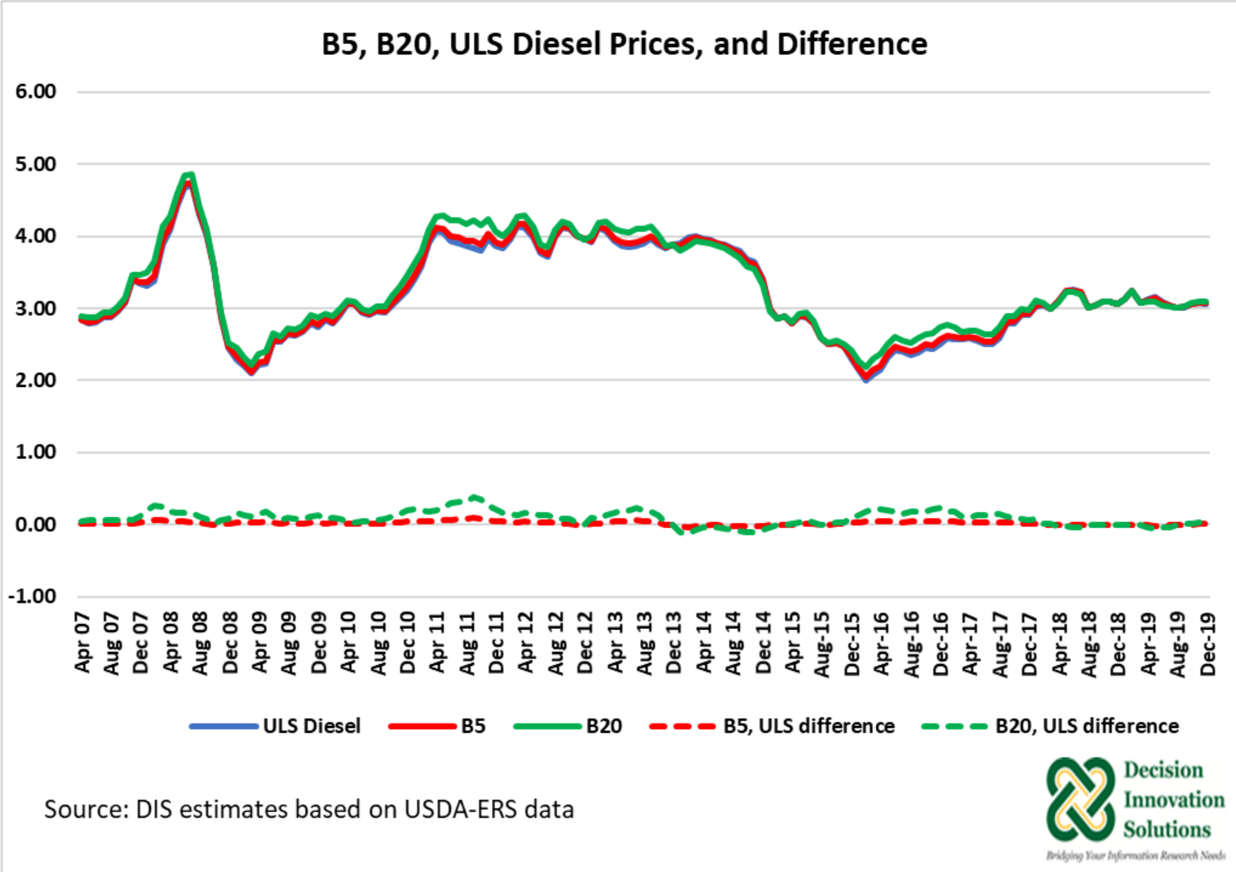


Figure 67, B5, B20, and ULS Diesel Prices and Difference

Under Scenario 2, by 2028 41.6% of the diesel sold in Missouri would be a B5 blend and 58.4% of the diesel sales would be a B20 blend. Currently, B5 blends sell at retail at a slight, but negligible, premium to Ultra Low Sulfur (ULS) diesel. With a substantial increase in the presence of biodiesel in Missouri by 2028, it is expected that B5 and B20 blends would maintain a competitive pricing position against ULS diesel.

Missouri Diesel-powered Vehicles

Data for the current number of diesel-powered trucks, buses/shuttle buses, and other vehicles in Missouri was provided from the Missouri Department of Revenue. Additionally, the Missouri Department of Revenue publishes a Vehicles per County Report which was used to identify the total number of all registered vehicles in the state by vehicle type. Statewide, there are 1,505,083 registered truck, 22,564 buses, and 17,268 RVs. There are 286,791 registered diesel-powered vehicles in Missouri for the 2019/2020 period. Of these, 90% are trucks (258,112), and it is estimated that 5% are buses/shuttles (14,340), and 5% are RVs or other vehicles (14,340).

The difference between the Actual Number of Diesel-powered Vehicles and Total Registered Vehicles (which includes gas powered vehicles) was calculated to identify the number of gasoline powered vehicles. This was calculated for trucks, buses, RV's, cars, and motorcycles. The percent share of diesel-powered vehicles was calculated for each vehicle type by taking the corresponding actual number of diesel-powered vehicles and dividing it by the total registered vehicles (including gasoline powered). For instance, the share of diesel-powered trucks = Actual Number of Diesel-Powered Trucks / Total Registered Trucks.

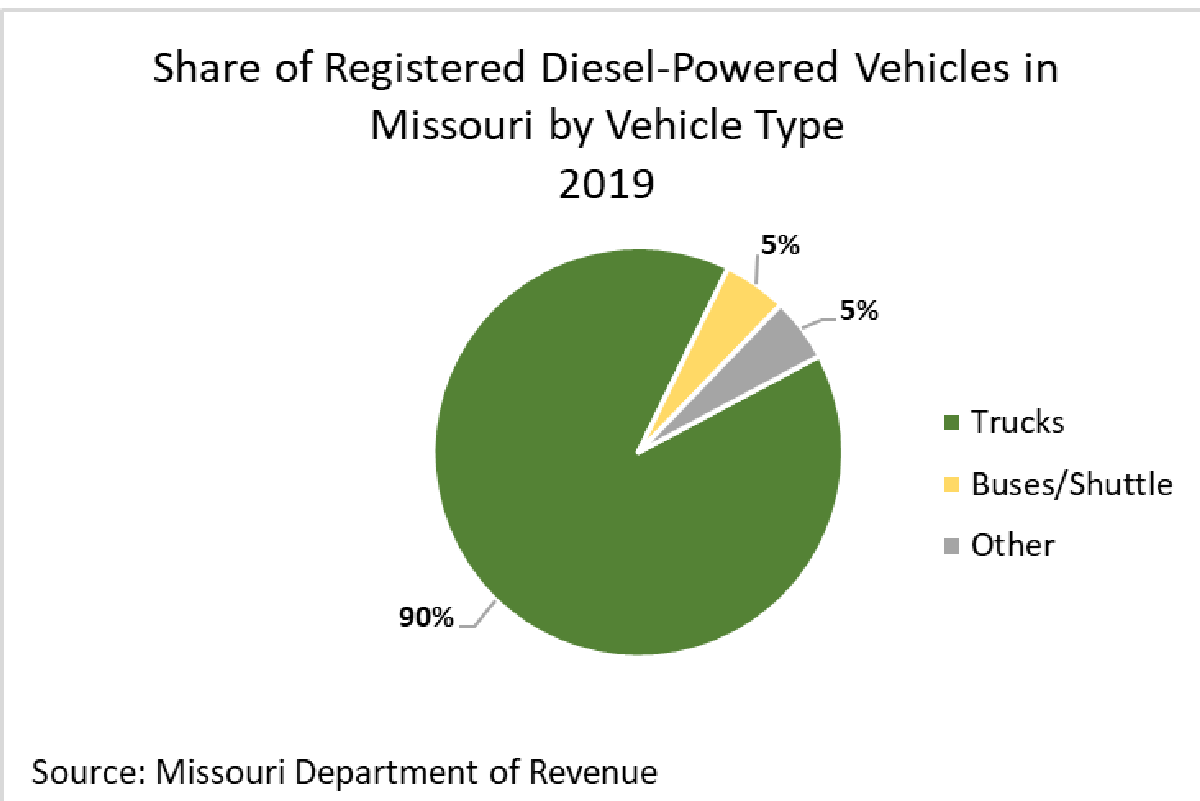


Figure 68, Share of Registered Diesel-Powered Vehicles in Missouri by Vehicle Type

There are 22,564 buses registered in the state of Missouri with 90% of those (258,112) being diesel powered. Figure 69 is an estimate of the number of diesel buses per county based on 63.55% of all buses registered in each county being diesel powered.

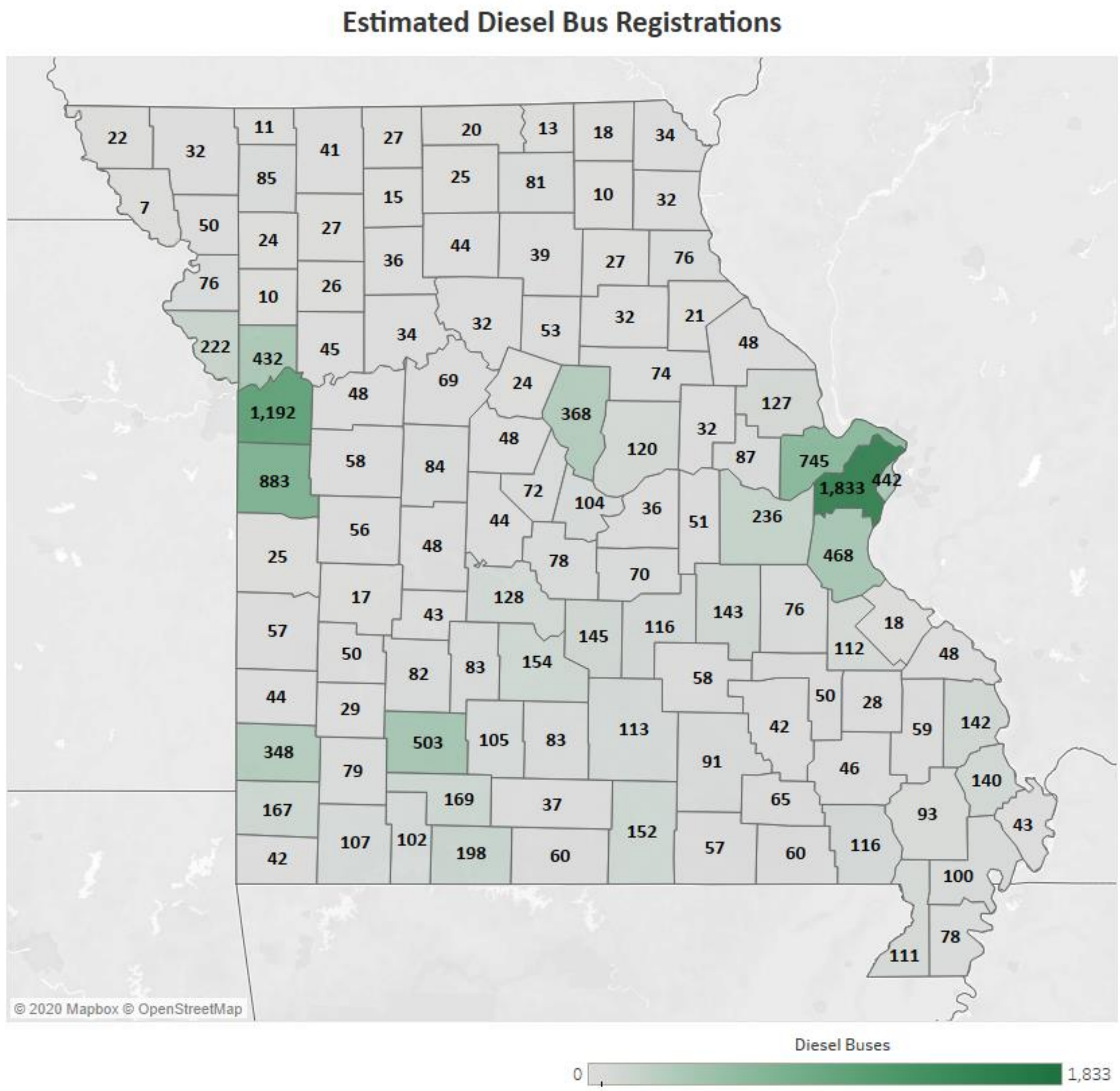


Figure 69, Estimated Diesel Bus Registrations

There are 17,268 RVs registered in Missouri with 14,340 of these being diesel powered. The estimates of registered diesel RVs in each county is the number of RVs registered in each county times the statewide diesel percentage of 83.04%.

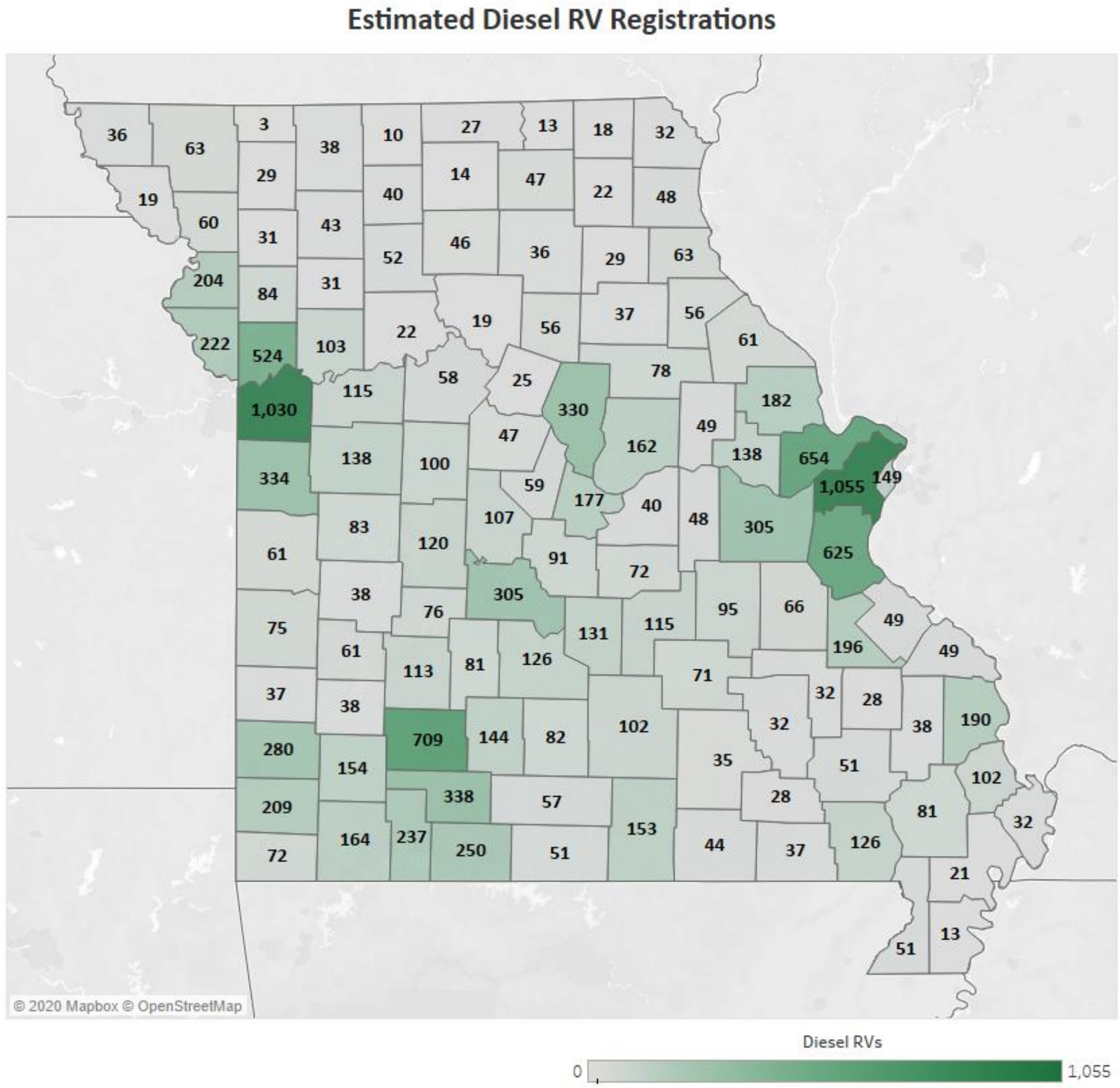


Figure 70, Estimated Diesel RV Registrations

There are 1,505,083 trucks registered in Missouri with 258,112 of them being diesel powered. The estimates of diesel truck registrations per county is the number of truck registrations in each county times the statewide prevalence of diesel-powered trucks which is 17.15%.

Estimated Diesel Truck Registrations

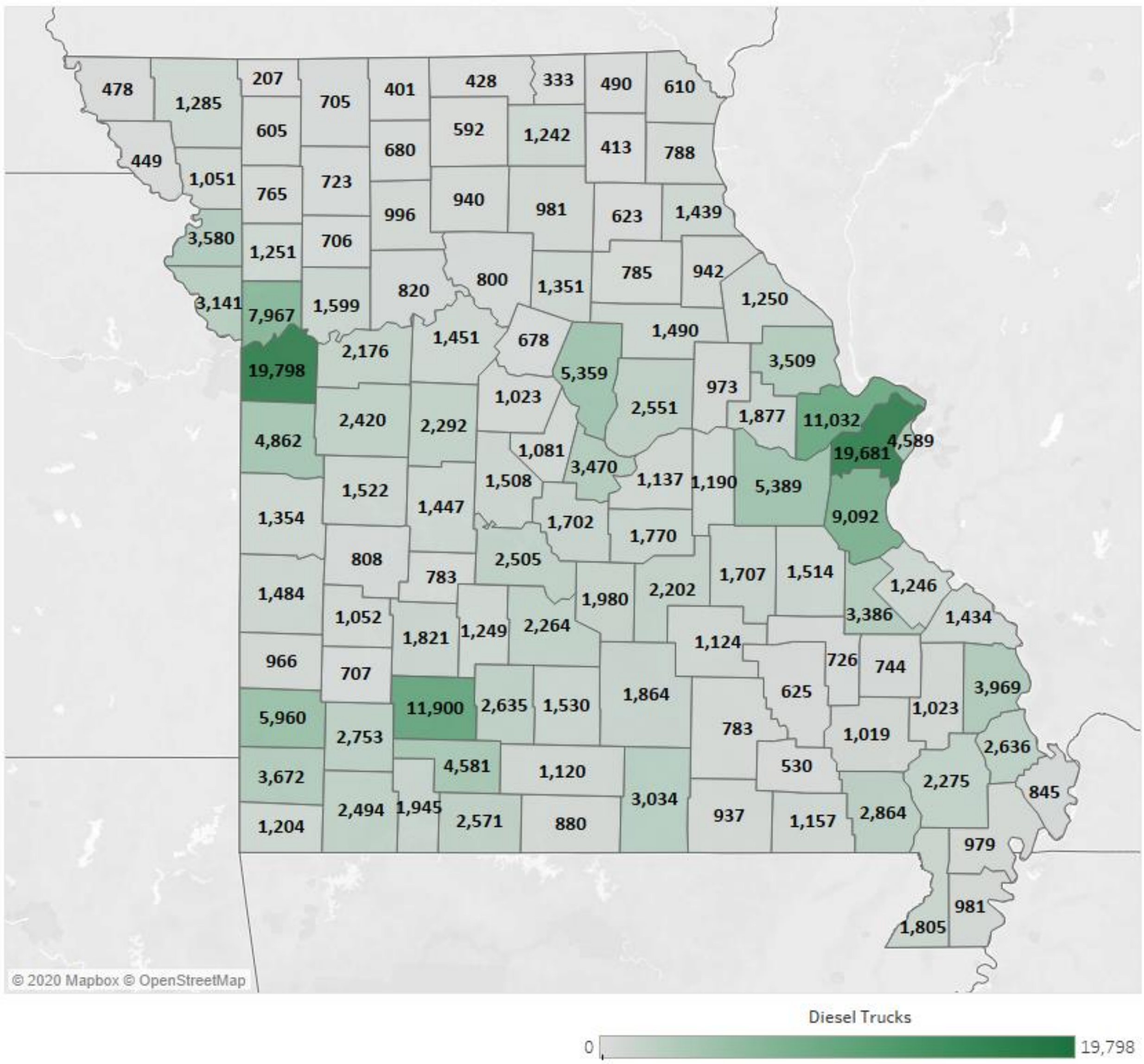


Figure 71, Estimated Diesel Truck Registrations

Research Implications/Suggestions for Further Research

Figure 72 shows the simulated 2028 soybean oil flow that would likely occur if a 50 million gallon per year biodiesel production facility were to be built in Scott County, MO. In the absence of new soybean crush capacity, the Scott County, MO facility would pull soybean oil from Adams Co, IL; Alexander Co, IL; and Macon Co, IL. Soybean oil flows to Audrain, Buchanan, Jackson, Randolph and Pemiscot Counties in Missouri would be nearly the same as modeled without the biodiesel production facility in Scott County, MO. Soybean oil flows to Independence County, AR, and Shelby County, TN would be significantly affected. Independence County, AR would need to procure soybean oil feedstocks from 5 soybean crush plants (Adams Co., IL; Alexander Co, IL; Audrain Co, MO; Jackson Co, MO; and Vernon Co., MO). The Shelby County, TN biodiesel facility would get much less soybean oil from Alexander Co, IL and more from Macon Co, IL.

Determining the optimal location of a new biodiesel production facility in Missouri would need more due diligence than afforded by a single flow analysis. Other considerations would be access to distribution systems (roads, rail, etc.) and a further investigation into supply and demand considerations. Also, items such as labor supply, utility support, etc. would be considered in a full feasibility study.

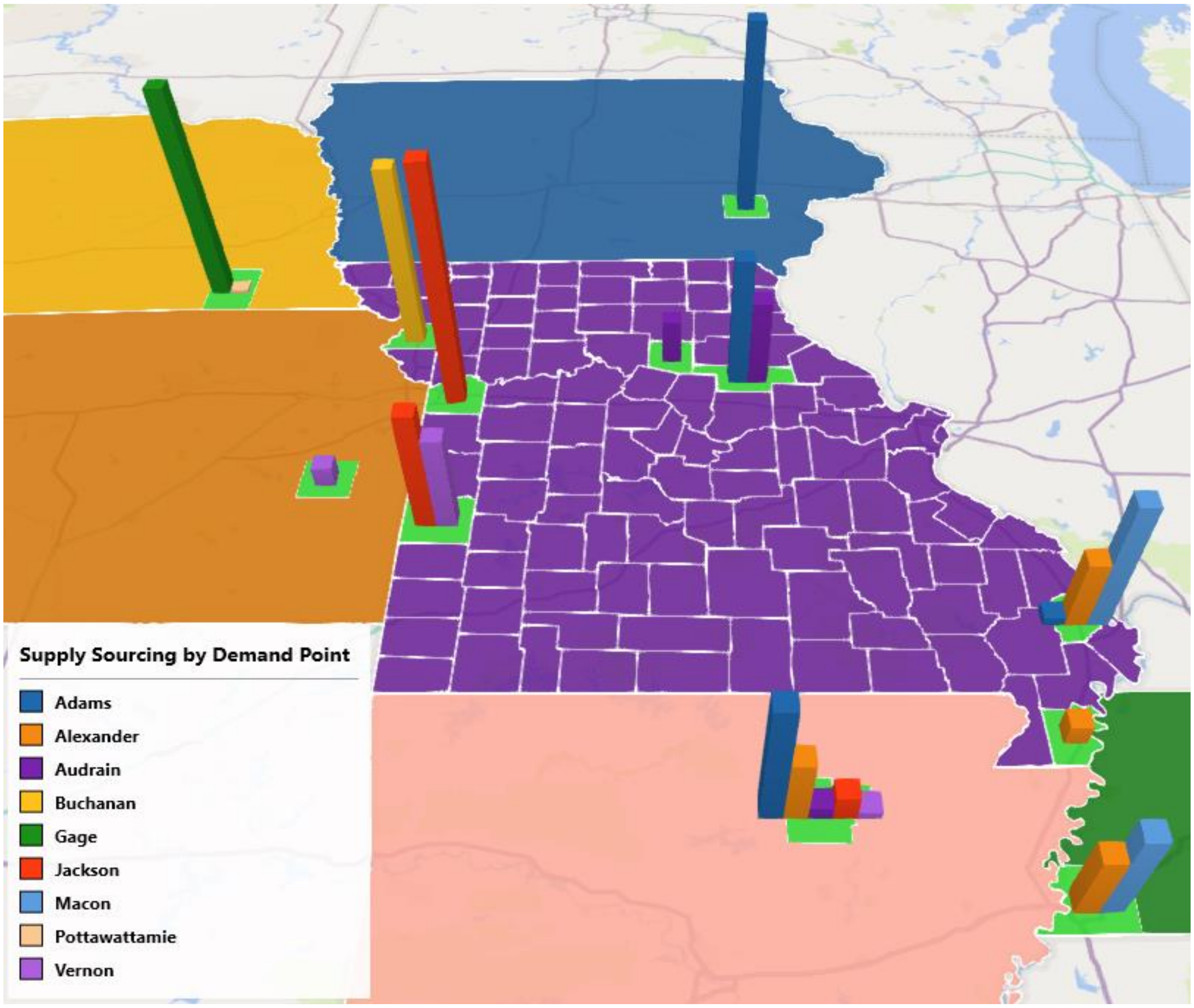


Figure 72 Soybean Oil Flow 2028 from Regional Processors to Biodiesel Plants, 2028, with a 50 Million Gallon Per Year Plant in Scott County, MO

Table 14 2028 Biodiesel Supply Sourcing by Demand Point (for Figure 72)

2028 Biodiesel Supply Sourcing by Demand Point for Figure 72									
100,000 Gallon Units									
	Soybean Oil Supply Points								
	Illinois			Iowa	Missouri				Nebraska
Biodiesel Plants	Adams	Alexander	Macon	Pottawattamie	Audrain	Buchanan	Jackson	Vernon	Gage
Independence, AR	240	125			25		47	16	
Washington, IA	347								
Anderson, KS								34	
Audrain, MO	227				151				
Buchanan, MO						317			
Jackson, MO							423		
Pemiscot, MO		38							
Randolph, MO					76				
Scott, MO	15	126	237						
Vernon, MO							212	166	
Gage, NE				6					372
Shelby, TN		125	177						

Figure 73 shows the supply sourcing of soybean oil by biodiesel plants in Missouri and the abutting CRDs if a 50 million gallon per year biodiesel plant were located in Scott County, MO and a 40 million bushel soybean processing facility were also located in Scott County.

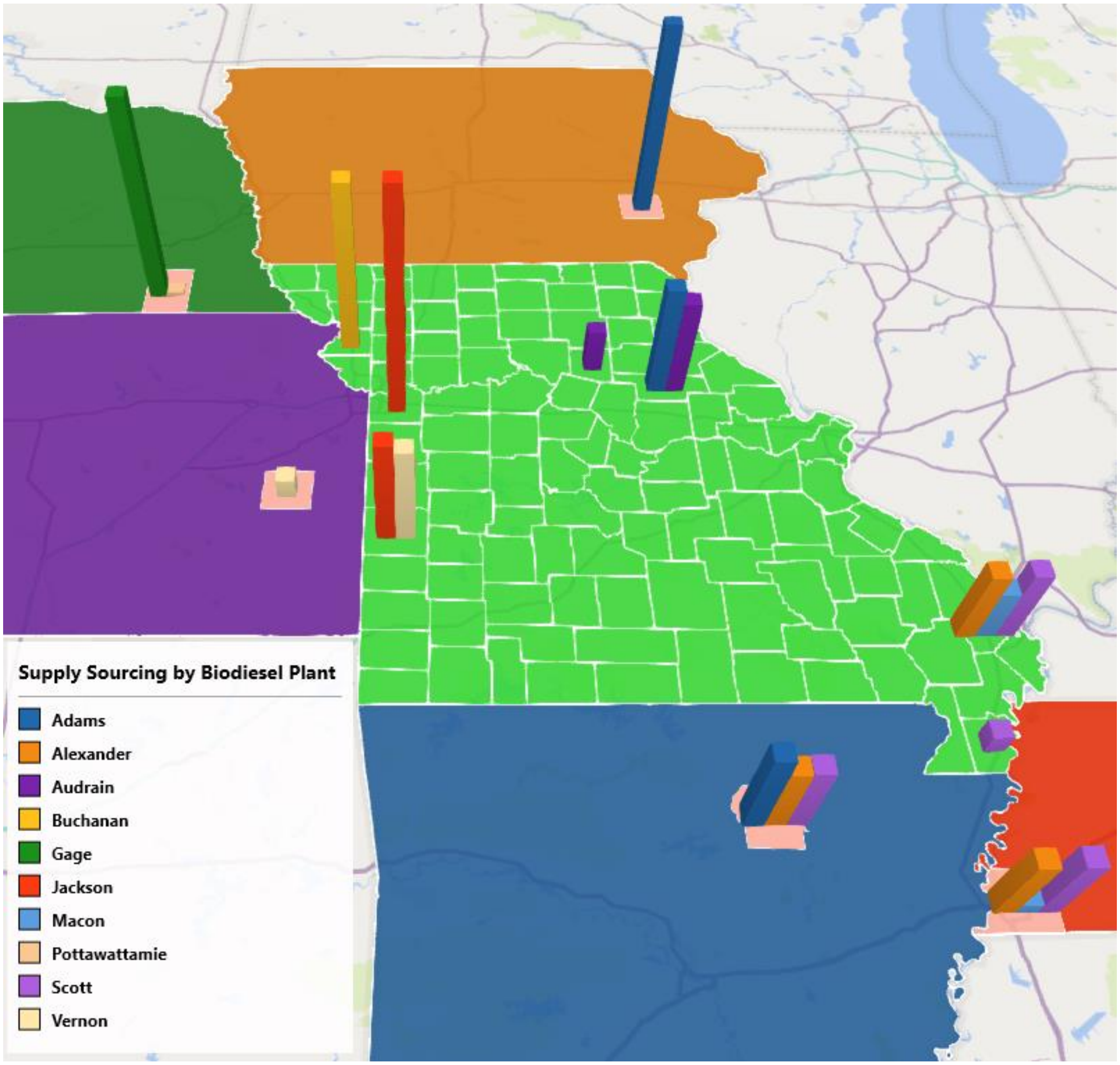


Figure 73 Soybean Oil Flow Analysis, 2028, with Scott Co, MO Biodiesel Production and Scott Co, MO Soybean Crush Facility

In this case, all of the Scott County soybean oil production would be used by the biodiesel production facilities in Scott Co, MO; Pemiscot Co, MO; Independence Co, AR and Shelby Co, TN. Audrain county biodiesel would still pull soybean oil from Audrain County, MO and Adams Co, IL. Soybean oil production in Buchanan County would be sufficient for Buchanan County biodiesel production. Jackson Co, MO soybean oil production would supply Jackson Co, MO and about half of the needs of the Vernon Co, MO biodiesel plant. Alexander Co, IL would supply soybean oil to Scott Co, MO; Independence Co, AR and Shelby Co, TN.

2028 Biodiesel Supply Sourcing by Demand Point for Figure 73										
100,000 Gallon Units										
	Soybean Oil Supply Points									
	Illinois			Iowa	Missouri					Nebraska
Soy Biodiesel Demand	Adams	Alexander	Macon	Pottawattamie	Audrain	Buchanan	Jackson	Scott	Vernon	Gage
Independence, AR	174	138						141		
Washington, IA	347									
Anderson, KS									34	
Audrain, MO	202				176					
Buchanan, MO						317				
Jackson, MO							423			
Pemiscot, MO								38		
Randolph, MO					76					
Scott, MO		138	99					141		
Vernon, MO							196		182	
Gage, NE				6						372
Shelby, TN		138	24					140		
Note: Dynamic Flow Model, 2028 with a 50 million gallon/year biodiesel plant and a 40 million bushel soybean processing plant in Scott Co, MO										

Further details regarding the building of and the optimal location for an additional soybean processing plant would be benefitted by doing a regional feed demand analysis and soybean meal demand flow analysis as well as additional analyses normally conducted as part of a feasibility study. The analysis conducted within this report suggests that if a new biodiesel plant were built in Scott County, MO then construction of a new soybean processing plant near the biodiesel plant would make sense from a soybean oil demand perspective.

Appendix A - Methodology

What-if Analysis of Policy Proposals (Consumption)

The "what-if" analysis section assesses the additional demand for soybeans if higher biodiesel blends (B5, B10, and B20) as part of a fuel standard were to be adopted in Missouri.

Since Missouri does not currently report volumes of biodiesel sold in the state, this data was estimated based on volumes of Missouri gross diesel (highway and non-highway) reported for fuel tax purposes. Missouri Department of Revenue publishes this data in the Motor Monthly Highway Report. Gross Missouri diesel data used does not include diesel exports, U.S. government diesel, losses, and allowance.

Historical Data

Biodiesel sales (highway and non-highway) for the historical period (January 2006 to December 2016) were based on the national trend of biodiesel mix. National consumption of diesel and biodiesel were sourced from the Energy Information Administration (EIA). According to this data, the biodiesel mix has varied from 0.63% in 2006 to 4.91 % in December 2016. For the purpose of this study, it was assumed that Missouri biodiesel mix was 5% starting in 2017.

Projected Data

Missouri diesel sales (highway and non-highway) were forecast from November 2019 to December 2028 using a linear trend projection method based on sales during the historical period of January 2013 to October 2019. The impact of increases in fuel economy standards, which is reflected in long term diesel projections was not considered in these projections assuming technology conducive to lower diesel/biofuel consumption would not be ready by the end of the ten-year projection period.

Biodiesel sales (highway and non-highway) were projected using the following three alternative settings:

Consumption Baseline:

The 5% biodiesel blend (B5) would continue throughout the projected period.

Scenario 1/policy proposal 1:

The 5% biodiesel blend (B5) would continue throughout March 2023. Then, from April 2023 to December 2028, the biodiesel blend would be 10% (B10) from April to October and B5 the rest of the year (November to March).

Scenario 2/policy proposal 2:

The 5 % biodiesel blend (B5) would continue throughout March 2023. From April 2023 to March 2025, the biodiesel blend would be B10 during April to October and B5 from November to

March. Then, from April 2025 to December 2028, the biodiesel mix would be 20% (B20) from April to October, and B5 during the rest of the year.

Monthly biodiesel consumption varies for the Baseline case, Scenario 1 and Scenario 2 according to the biodiesel blend stipulated by the policy. Overall, monthly biodiesel consumption is estimated by:

- Monthly Biodiesel Consumption =Monthly diesel consumption X Percent,
- Where percent is equal to biodiesel blend based on the policy.

Based on Baseline, Scenario 1, and Scenario 2 impacts on soybean oil (SBO) demand and soybean usage/crush were estimated.

Soybean oil (SBO) usage by biodiesel sold (consumed) in Missouri:

Based on available data, in 2019 about 85% of Missouri biodiesel production was SBO based biodiesel, the remaining 15% of production was animal fat based and was destined to other markets such as the California market to supply part of that state fuel standard needs. Therefore, SBO demand was estimated as a percentage of feedstock assuming all biodiesel consumed in Missouri was SBO based biodiesel (100% biodiesel fuel). A conversion factor of 7.55 pounds of soybean oil per gallons of biodiesel was used to estimate the volume (pounds) of SBO demand for highway and non-highway biodiesel for the Baseline case biodiesel consumption and the two alternative scenarios.

Soybean Usage/Crush by biodiesel consumed in Missouri:

The soybean oil content of Missouri soybeans was factored into determining the soybean demand based on the Baseline case, Scenario 1, and Scenario 2. The historical (2006 to 2018) SBO content of Missouri soybeans was sourced from the U.S. Soybean Quality Reports from the University of Minnesota. Due to the lack of data for Missouri soybean oil content in 2006 the average U.S. SBO content of soybeans (19.2%) was used instead.

The volume (pounds) of SBO rendered per bushel of soybean was estimated as:

SBO content of Missouri soybeans X 60 pounds.

The volume (bushels) of soybeans used in biodiesel sold was estimated as:

SBO used in biodiesel sold/SBO rendered

The volume of soybean usage/crush was estimated for highway biodiesel and non-highway biodiesel for the Baseline case, Scenario 1 and Scenario 2.

Impact on Soybean Movement

This section analyses the impact of a resulting change in movement of soybeans throughout Missouri and surrounding areas if higher biodiesel blends (B5, B10, and B20) as part of a fuel standard were to be adopted in Missouri. The analysis starts by evaluating three different models: Missouri biodiesel model, Regional biodiesel model, and Neighbor state biodiesel model.

Missouri Biodiesel Model

The Missouri biodiesel model includes only Missouri's current plant capacity (i.e., biodiesel unused capacity from other nearby states is not considered in the analysis).

Given the new fuel standard and Missouri current biodiesel plant capacity, the analysis seeks to evaluate the state's position to supply the anticipated increase in domestic biodiesel demand, the impact on Missouri's biodiesel out of state shipments, and the needs that may arise for expanding plant capacity. This analysis is carried out from two perspectives: a) Scalping case (Satisfying Missouri markets first and out-of-state markets only to the extent that supplies are sufficient) and b) No-scalping case (Out-of-state markets are maintained as in-state use increases). In the scalping case, total production is not allowed to increase beyond baseline (current) plant capacity (17.750 million gallons/month, 213.0 million gallons/year). In order to supply Missouri biodiesel demand using current production capacity, out of state shipments would decline when domestic demand grows above current production capacity (when capacity utilization reaches 100%). This analysis reflects how much Missouri's biodiesel shipments to external market would decline under these conditions. In the No-scalping case, both Missouri biodiesel demand and out of state shipments are kept (out of state shipments are not allowed to decline). The analysis indicates when the need for new capacity arises in order to supply both markets.

Important assumptions and parameters used in these analyses:

***Baseline case, Scenario 1, and Scenario 2*:**

- All biodiesel production is soybean oil (SBO) based biodiesel,
- Current (2019) Missouri SBO-based biodiesel production= 170 million gallons/year, 14.167 million gallons/month,
- Current (2019) Missouri baseline capacity = 213 million gallons/year, 17.750 million gallons/month
- Baseline biodiesel production during January to December 2019= 170 million gallons/year, 14.1667 million gallons/month.

- Forecast monthly baseline biodiesel production from 2020 to 2028=

baseline production during previous year X diesel consumption annual average growth rate from 2019-2028 (1.0166)

Baseline (B5) case only:

Case A: Scalping

- Biodiesel (BD) out of state shipments:

when baseline production < capacity:

BD out of state shipments= baseline production – MO Baseline case consumption

when baseline production > capacity:

BD out of state shipments= baseline capacity – MO Baseline case consumption

Case B: No-scalping:

- BD out of state shipments=

baseline production – MO Baseline case consumption

Note that all the variables were estimated on a monthly basis.

Scenario 1 only

In anticipation of the biodiesel mix increase to B10, the following variables were added to the analysis:

- Monthly production above baseline (MPAB) in Scenario 1, defined as the amount by which the monthly production had to start growing in anticipation of the 10% mix (B10) starting in April 2023. Production begins to grow five months before (November 2022) the biodiesel policy is implemented.

MPAB= (Total April to October Baseline consumption - Total April to October Scenario 1 consumption)/12.

Note: The MPAB estimate starts on November of the year prior to the policy implementation and continues throughout the projected period.

- Monthly total production = Monthly Baseline production + MPAB

Note: In the scalping case, monthly total production maximizes at monthly baseline capacity

- Monthly biodiesel storage = Baseline consumption – Scenario 1 consumption + production above baseline

Note: From November to March monthly biodiesel storage is equal to MPAB because consumption for both the Baseline case and Scenario 1 is at B5.

From April to October monthly biodiesel storage is below zero and the value in absolute terms is about 70% of production above baseline volume. April to October are the months when B10 consumption is effective (starting in April 2023).

- Monthly biodiesel cumulative storage = Previous month storage + current month storage.

Note: Cumulative storage increases from November to March and it starts declining in April until it reaches zero in October. This process continues throughout the projected period.

Scenario 1 Case A: Scalping

- Monthly total production is not allowed to increase beyond baseline production capacity (17.750 million gallons). In the scalping case the objective is to supply Missouri biodiesel demand using the current production capacity.
- Monthly biodiesel shipped out of state:

  when monthly total production < monthly production capacity =

  Monthly total production – MO monthly consumption Scenario 1 – monthly storage

when monthly total production > monthly production capacity =

  Monthly production capacity – MO monthly consumption Scenario 1 – monthly storage

  Note: In Scenario 1 Case A Scalping, out of state shipments continually decline once capacity is maximized in order to continue supplying Missouri's biodiesel demand.

Scenario 1 Case B: No-scalping

- In the No-scalping case the objective is to supply Missouri biodiesel demand while keeping the out of state markets. In this case monthly total production could increase beyond production capacity (17.750 million gallons). New capacity needed is estimated in this case.

- Monthly biodiesel shipped out of state =

  Monthly total production – MO monthly consumption Scenario 1 – monthly storage

- When production capacity is reached, new capacity needed is estimated as follows:

  Monthly new capacity needed=monthly total production – monthly production capacity.

  Note: monthly production capacity increases annually with the previous year's new capacity needed/built.

  Every year new capacity built =maximum monthly capacity needed during that year.

Scenario 2 only

To prepare for the biodiesel mix increase in biodiesel consumption starting April 2023 for B10, and April 2025 for B20, the following variables were added to the analysis:

- Monthly production above baseline (MPAB) in Scenario 2, defined as the amount by which the monthly production had to start growing in anticipation of the 10% mix (B10) consumption starting in April 2023 and 20% mix (B20) beginning in April 2025. Production begins to grow six months before (November 2022) the biodiesel policy is implemented.

MPAB= (Total April to October Baseline consumption - Total April to October Scenario 2 consumption)/12.

Note: The MPAB estimate starts on November of the year prior to the policy implementation and continues throughout the projected period.

- Monthly total production = monthly baseline production+ MPAB

Note: In the scalping case, monthly total production maximizes at monthly baseline capacity.

- Monthly biodiesel storage = Baseline consumption – Scenario 2 consumption + production above baseline

Note: From November to March monthly biodiesel storage is equal to MPAB because consumption for both the Baseline case and Scenario 2 is at B5.

From April to October monthly biodiesel storage is below zero and the value in absolute terms is about 70% of production above baseline volume. From April to October consumption of B10 (starting in April 2023) and B20 (starting in April 25) is in effect.

- Monthly biodiesel cumulative storage = Previous month storage + current month storage.

Note: Cumulative storage increases from November to March and it starts declining in April until it reaches zero in October. This process continues throughout the projected period.

Scenario 2 Case A: Scalping

- Monthly total production is not allowed to increase beyond production capacity (17.750 million gallons). In the scalping case the objective is to supply Missouri biodiesel demand using the current production capacity. External markets could be lost in this case.
- Monthly biodiesel shipped out of state:

when monthly total production < monthly production capacity =

Monthly total production – MO monthly consumption Scenario 2– monthly storage

when monthly total production > monthly production capacity =

Monthly production capacity – MO monthly consumption Scenario 2– monthly storage

Scenario 2 Case B: No-scalping

- In the No-scalping case the objective is to supply Missouri biodiesel demand while keeping the out of state markets. In this case monthly total production increases beyond monthly production capacity (17.750 million gallons). New capacity needed is estimated in this case.
- Monthly biodiesel shipped out of state =

Monthly total production – MO monthly consumption Scenario 2 –monthly storage

- When production capacity is reached, new capacity needed is estimated as follows:

  Monthly new capacity needed = monthly total production – monthly production capacity.

  Note that monthly production capacity increases annually with the previous year's new capacity built.

  Every year new capacity built =maximum monthly capacity needed during that year.

Regional Biodiesel Production Model

The Regional Biodiesel Production Model expands the Missouri production model by adding to Missouri's biodiesel plant capacity the unused biodiesel production capacity of biodiesel plants in eight states located about 100 miles from Missouri. To meet the distance requirement only a few regions (agricultural districts) within those states were selected. Table 15 shows the additional states and agricultural districts included in this analysis. Plant capacity reflects the total capacity within the selected agricultural districts, but not all agricultural districts in the specific states have biodiesel plants. For example, in Arkansas the 60 million gallons/year capacity corresponds to only one of the selected agricultural districts with a biodiesel plant (agricultural district 30), Agricultural districts 10, 20, 40 do not have any biodiesel plants.

For each state the 2019 unused biodiesel plant capacity was estimated as:

Unused biodiesel plant capacity =biodiesel plant capacity X 26%

The assumption here was that plant capacity utilization in the selected states was 74% of 2018 total capacity, which was the U.S. biodiesel capacity utilization in 2018. Therefore, the unused capacity was the remaining 26%. In additions, the analysis assumed unused plant capacity started to decline at a 0.0833% rate each month (1% annual rate compounded monthly) starting in February 2019.

Table 15, Selected States and Regions (Agricultural Districts): January 2019 Capacity and Unused Biodiesel Plant Capacity

Selected States and Regions (Agricultural Districts): January 2019 Used and Unused Biodiesel Plant Capacity

States	Regions Selected Agricultural Districts [1/]	BD Plant Capacity [2/] (Million	BD Unused Capacity [3/] (Million gallons/year)
ARKANSAS	10, 20, 30, 40	60	15.6
ILLINOIS	30, 60, 80	0	0.0
IOWA	70, 80, 90	46	12.0
KANSAS	70, 80, 90	5	1.2
KENTUCKY	10	0	0.0
NEBRASKA	90	50	13.0
OKLAHOMA	70, 80	0	0.0
TENNESSEE	10	40	10.4
Total		201	52.1

Source: Plant capacity: Biodiesel Magazine. Unused capacity: DIS estimates

1/ The agricultural districts (ADs) within each state are located at a distance of about 100 miles from the state of Missouri

2/ Not all ADs selected in the states included have biodiesel plants, for example, in Arkansas the 60 million gallons/year capacity corresponds to AD 30, ADs 10, 20, and 40 do not have biodiesel plants.

3/ 2019 Unused capacity= BD plant capacity *26%, assuming the plant capacity utilization in these states was 74% of 2018 total BD capacity, which was the U.S. biodiesel capacity utilization in 2018.

Neighbor State Biodiesel Model

In the case of the Neighbor State Biodiesel Model, Missouri baseline capacity was expanded by adding the unused plant capacity of all the biodiesel plants in the selected eight states (Table 16). In this case, biodiesel plants can be as far as 300 to 500 miles away from Missouri. Not all agricultural districts in the states selected have biodiesel plants, for example, in Arkansas the 115 million gallons/year capacity is the volume of the plants located in three agricultural districts.

The same assumptions as in the regional model were used in the Neighbor state model:

- For each state unused capacity by January 2019 was equals 26% of total capacity installed in the state that year, and
- Unused capacity declines 0.0833% per month starting in February 2019.

Table 16, Selected Neighbor States: January 2019 Used and Unused Biodiesel Plant Capacity

Selected Neighbor States: January 2019 Used and Unused Biodiesel Plant Capacity

States	Selected Agricultural Districts 1/	BD Plant Capacity 2/ (Million gallons/year)	BD Unused Capacity 3/ (Million gallons/year)
ARKANSAS	All	115.0	29.9
ILLINOIS	All	170.1	44.2
IOWA	All	400.0	104.0
KANSAS	All	64.0	16.6
KENTUCKY	All	47.1	12.2
NEBRASKA	All	51.0	13.3
OKLAHOMA	All	45.0	11.7
TENNESSEE	All	82.0	21.3
Total		974.2	253.3

Source: Plant capacity: Biodiesel Magazine. Unused capacity: DIS estimates

1/ The agricultural districts (ADs) within each state are located at a distance of about 300 -500 miles from the state of Missouri

2/ Not all ADs the states included have biodiesel plants, for example, in Arkansas the 115 million gallons/year capacity corresponds to three AD (30, 60, and 90). The other ADs do not have biodiesel plants.

3/ 2019 Unused capacity= BD plant capacity *26%, assuming the plant capacity utilization in these states was 74% of 2018 total BD capacity, which was the U.S. biodiesel capacity utilization in 2018.

Appendix B - Summary of Biodiesel Policy Analysis

Table 17, Policy Analysis Summary: Missouri Biodiesel Model

Policy	Missouri Biodiesel Model[1]
Baseline Case: B5[2]	• Consumption (in-state-demand): 2019: 74 million gallons, 2028: 86 million gallons • Existing capacity: 213 million gallons • Production: 2019: 170 million gallons, 2028: 197 million gallons • Out of state shipments: 2019: 96 million gallons, 2028: 111 million gallons • Capacity utilization: 2019: 80%, 2028: 93% • Total demand (2028): 197 million gallons (in state demand + out of state shipments) Note: Scalping and no-scalping are the same given the large capacity compared with demand
Scenario 1: B10[3]	• Consumption (in-state-demand): 2019: 74 million gallons, 2028: 137 million gallons • Existing capacity: 213 million gallons • Production (1A, scalping): 2019: 170 million gallons, 2028: 213 million gallons • Out of state shipments (1A, scalping): 2019: 96 million gallons, 2028: 76 million gallons • Capacity utilization (1A, scalping): 2019: 80%, 2028: 100% • Production (1B, no-scalping): 2019: 170 million gallons, 2028: 248 million gallons • Out of state shipments (1B, no-scalping): 2019: 96 million gallons, 2028: 111 million gallons • Total demand by 2028 (1B, no-scalping): 248 million gallons (in state demand + out of state shipments) • Capacity utilization (1B, no-scalping): 2019: 80%, 2028: 116%
Scenario 2: B20[4]	• Consumption (in-state-demand): 2019: 74 million gallons, 2028: 237 million gallons • Existing capacity: 213 million gallons • Production (2A, scalping): 2019: 170 million gallons, 2028: 213 million gallons • Out of state shipments (2A, scalping): 2019: 96 million gallons, 2028: none (deficit= 25 million gallons) • Capacity utilization (2A, scalping): 2019: 80%, 2028: 100% • Production (2B, no-scalping): 2019: 170 million gallons, 2028: 349 million gallons • Out of state shipments (2B, no-scalping): 2019: 96 million gallons, 2028: 111 million gallons • Total demand by 2028 (2B, No-scalping): 348.6 million gallons (in-state demand + out of state shipments) • Capacity utilization (2B, no-scalping): 2019: 80%, 2028: 164%

Source: DIS estimates

[1] Includes only Missouri biodiesel production capacity.

[2] Baseline case: B5 would be consumed to the end of the projected period (2028).

[3] Scenario 1: Jan 2017-Mar 2023: B5. 2023-2028: Apr-Oct: B10, Nov-Mar: B5.

[4] Scenario 2: Jan 2017-Mar 2023: B5; 2023-2025: Apr-Oct B10, Nov-Mar: B5; 2025-2028: Apr-Oct: B20, Nov-Mar: B5.

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Table 18, Policy Analysis Summary: Regional Biodiesel Model

Policy	Regional Biodiesel Model[1]
Baseline Case: B5[2]	• Consumption (in-state-demand): 2019: 74 million gallons, 2028: 86 million gallons • Existing capacity (2028): 260 million gallons (MO: 213 + unused abutting states: 47) • Production: 2019: 170 million gallons, 2028: 197 million gallons • Out of state shipments: 2019: 96 million gallons, 2028: 111 million gallons • Capacity utilization: 2019: 64%, 2028: 76% • Total demand (2028): 197 million gallons (in state demand + out of state shipments) Note: Scalping and no-scalping are the same given the large capacity compared with demand
Scenario 1: B10[3]	• Consumption (in-state-demand): 2019: 74 million gallons, 2028: 137 million gallons • Existing capacity by 2028: 260 million gallons (MO: 213 + unused abutting states: 47) • Production (1A, scalping and 1B, no-scalping): 2019: 170 million gallons, 2028: 248 million gallons • Out of state shipments (1A, scalping and 1B, no-scalping): 2019: 96 million gallons, 2028: 111 million gallons • Capacity utilization (scalping and no-scalping): 2019: 60%, 2028: 95% • Total demand (2028): 248 million gallons (in state demand + out of state shipments) Note: Scalping and no-scalping are the same given the large capacity compared with demand
Scenario 2: B20[4]	• Consumption (in-state-demand): 2019: 74 million gallons, 237 million gallons • Existing capacity by 2028: 260 million gallons (MO: 213 + unused abutting states: 47) • Production (2A, scalping): 2019: 170 million gallons, 2028: 260 million gallons • Out of state shipments (2A, scalping): 2019: 96 million gallons, 2028: 23 million gallons • Capacity utilization (2A, scalping): 2019: 64%, 2028: 100% • Production (2B, no-scalping): 2019: 170 million gallons, 2028: 349 million gallons • Out of state shipments (2B, no-scalping): 2019: 96 million gallons, 2028: 111 million gallons • Total demand by 2028 (2B, no-scalping): 348.6 million gallons (in state demand + out of state shipments) • Capacity utilization (2B, no-scalping): 2019: 64%, 2028: 134% • New capacity need (2028): 90 million gallons • Consider building a plant in MO: 50 million gallons

Source: DIS estimates

[1] States included: IL, IA, NE, KS,AR, OK, KY, and TN. 26% of biodiesel production capacity in the selected CRDs of abutting states is available for production of biodiesel to meet the demands of Missouri in-state use and out-of-state markets.

[2] Baseline case: B5 would be consumed to the end of the projected period (2028).

[3] Scenario 1: Jan 2017-Mar 2023: B5. 2023-2028: Apr-Oct: B10, Nov-Mar: B5.

[4] Scenario 2: Jan 2017-Mar 2023: B5; 2023-2025: Apr-Oct B10, Nov-Mar: B5; 2025-2028: Apr-Oct: B20, Nov-Mar: B5.

Table 19, Policy Analysis Summary: Neighbor Biodiesel Model

Policy	Neighbor Biodiesel Model[1]
Baseline Case: B5[2]	• Consumption (in-state-demand): 2019: 74 million gallons, 2028: 86 million gallons • Existing capacity (2028): 444 million gallons (MO: 213 + unused abutting states: 231) • Production: 2019: 170 million gallons, 2028: 197 million gallons • Out of state shipments: 2019: 96 million gallons, 2028: 111 million gallons • Capacity utilization: 2019: 37%, 2028: 44% • Total demand (2028): 197 million gallons (in state demand + out of state shipments) Note: Scalping and no-scalping are the same given the large capacity compared with demand
Scenario 1: B10[3]	• Consumption (in-state-demand): 2019: 74 million gallons, 2028: 137 million gallons • Existing capacity by 2028: 444 million gallons (MO: 213 + unused abutting states: 231) • Production (1A, scalping and 1B, no-scalping): 2019: 170 million gallons, 2028: 248 million gallons • Out of state shipments (1A, scalping and 1B, no-scalping): 2019: 96 million gallons, 2028: 111 million gallons • Capacity utilization (scalping and no-scalping): 2019: 37%, 2028: 56% • Total demand (2028): 248 million gallons (in state demand + out of state shipments) Note: Scalping and no-scalping are the same given the large capacity compared with demand
Scenario 2: B20[4]	• Consumption (in-state-demand): 2019: 74 million gallons, 237 million gallons • Existing capacity by 2028: 444 million gallons (MO: 213 + unused abutting states: 231) • Production (1A, scalping and 1B, no-scalping): 2019: 170 million gallons, 2028: 349 million gallons • Out of state shipments (1A, scalping and 1B, no-scalping): 2019: 96 million gallons, 2028: 111 million gallons • Capacity utilization (scalping and no-scalping): 2019: 37%, 2028: 79% • Total demand by 2028 (Scalping and no-scalping): 349 million gallons (in-state + out of state) Note: Scalping and no-scalping are the same given the large capacity compared with demand

Source: DIS estimates

[1] States included: IL, IA, NE, KS,AR, OK, KY, and TN. 26% of all biodiesel production capacity in the abutting states is available for production of biodiesel to meet the demands of Missouri in-state use and out-of-state markets.

[2] Baseline case: B5 would be consumed to the end of the projected period (2028).

[3] Scenario 1: Jan 2017-Mar 2023: B5. 2023-2028: Apr-Oct: B10, Nov-Mar: B5.

[4] Scenario 2: Jan 2017-Mar 2023: B5; 2023-2025: Apr-Oct B10, Nov-Mar: B5; 2025-2028: Apr-Oct: B20, Nov-Mar: B5.

Appendix C Fuel Terminals

Fuel Terminals in Missouri

There are 20 fuel terminals in Missouri. St. Louis City has four of the terminals, two are in Lawrence County (Mount Vernon) with one each in Boone, Cape Girardeau, Carroll, Cole, Greene, Jackson, Jasper, Lewis, Marion, Pemiscot, Platte, St. Charles, St. Louis, and Scott counties. Biodiesel will move from biodiesel production facilities through these terminals for distribution to truck stops, auto fuel retailers, cooperatives, wholesale distributors and farms.

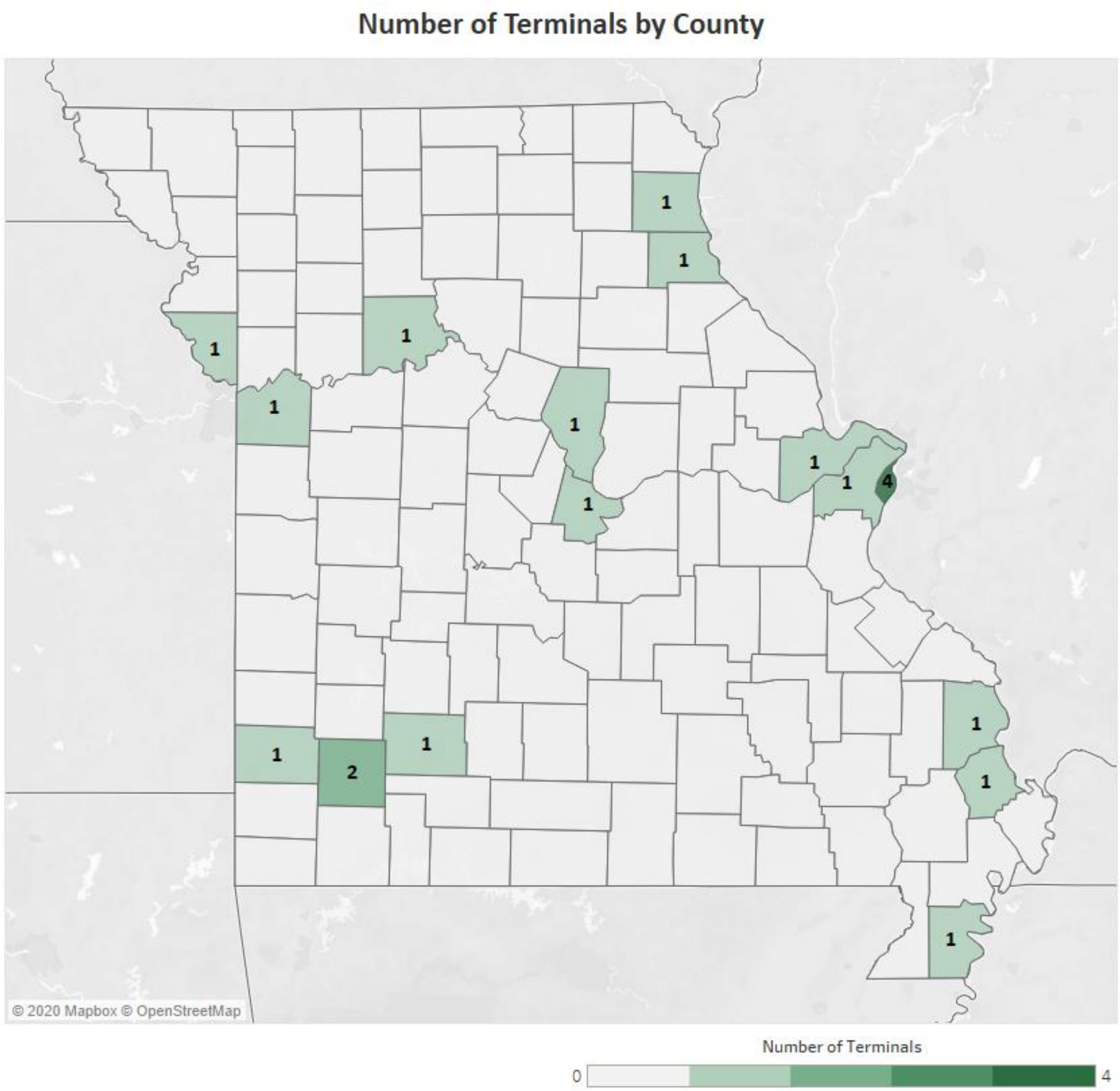

Figure 74, Number of Terminals by County

Fuel Terminals in Missouri and the Regional CRDs

Figure 75 shows the 51 fuel terminals that are within the expanded biodiesel study region. There are 20 within Missouri and 31 within the crop reporting districts that abut Missouri.

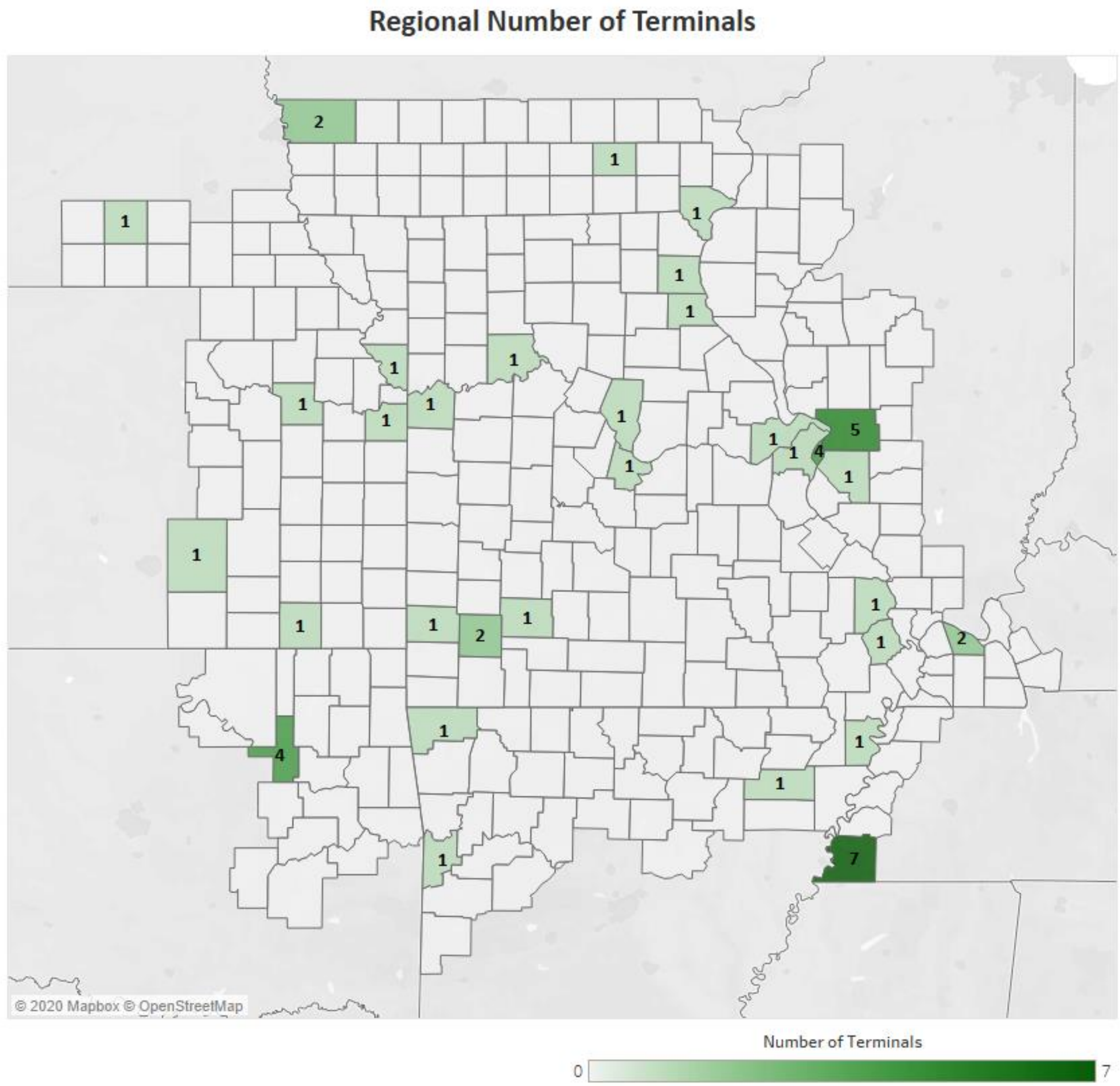

Figure 75, Regional Number of Terminals by County

Appendix D Dynamic Flow Map Data

2019 Biodiesel Supply Sourcing by Demand Point for Figure 56

Table 20 2019 Biodiesel Supply Sourcing by Demand Point -- Data for Figure 56

2019 Biodiesel Supply Sourcing by Demand Point for Figure 56 100,000 Gallon Units						
	Missouri Soy-based Biodiesel Production Facilities					
County	**Audrain**	**Buchanan**	**Jackson**	**Pemiscot**	**Randolph**	**Vernon**
Southern Out-of-State (AR)	62			2		32
Eastern Out-of-State (IL)	65		93		17	17
Western Out-of-State 1 (KS)		44	174			118
Western Out-of-State 2 (KS)		219				117
Adair					2	
Andrew		5				
Atchison		6				
Audrain	4					
Barry						2
Barton						4
Bates						6
Benton						1
Bollinger				1		
Boone	12					
Buchanan		9				
Butler	3			2		
Caldwell		3				
Callaway	8					
Camden						2
Cape Girardeau	6			2		
Carroll					3	
Carter				1		
Cass			10			
Cedar						1
Chariton					3	
Christian						3
Clark	3					
Clay			26			
Clinton		2				
Cole	5					
Cooper					4	
Crawford	3					
Dade						1
Dallas						2
Daviess		3				
De Kalb		3				

Dent	1					
Douglas						1
Dunklin	2			2		
Franklin	18					
Gasconade	1					
Gentry		2				
Greene						18
Grundy		2				
Harrison		4				
Henry						5
Hickory						1
Holt		6				
Howard					2	
Howell	2			3		
Iron				1		
Jackson			89			
Jasper						13
Jefferson	17					
Johnson			5			
Knox					2	
Laclede						6
Lafayette			11			
Lawrence						8
Lewis	3					
Lincoln	4					
Linn					5	
Livingston		3				
Macon					2	
Madison				1		
Maries	6					
Marion	3					
McDonald						5
Mercer		1				
Miller					2	
Mississippi	1			3		
Moniteau					2	
Monroe	2					
Montgomery	3					
Morgan					2	
New Madrid	3			3		
Newton						10
Nodaway		4				
Oregon				1		
Osage	2					
Ozark				1		
Pemiscot	7			2		

Perry				2		
Pettis			4			
Phelps	4					
Pike	4					
Platte		19				
Polk						3
Pulaski	4					
Putnam					1	
Ralls	3					
Randolph					2	
Ray			2			
Reynolds				1		
Ripley				1		
Saline					8	
Schuyler					1	
Scotland					2	
Scott	4			2		
Shannon				1		
Shelby					2	
St Charles	23					
St Clair						2
St Francois	1			2		
St Louis	65		34		16	
St Louis City	33					
Ste. Genevieve	2			2		
Stoddard	4			2		
Stone						1
Sullivan					2	
Taney						3
Texas	3					
Vernon						6
Warren	3					
Washington	1					
Wayne				2		
Webster						4
Worth		1				
Wright						3

2028 Regional Biofuel Supply Sourcing by Demand Point With 50 MGY Plant in Scott Co. (for Figure 57)

Table 21 2028 Regional Biodiesel Supply Sourcing by Demand Point with 50 MGY Plant in Scott County, MO (for Figure 57)

	2028 Biodiesel Supply Sourcing by Demand Point for Figure 57 100,000 Gallon Units													
	Arkansas	Iowa	Kansas			Missouri							Nebraska	Tennessee
County	Independence	Washington	Anderson	Morris	Riley	Audrain	Buchanan	Jackson	Pemiscot	Randolph	Scott	Vernon	Gage	Shelby
Southern Out-of-State (AR)									9					102
Eastern Out-of-State (IL)		9				42		72			97			2
Western Out-of-State 1 (KS)	16		12	170			63					78	49	
Western Out-of-State 2 (KS)	16				170		61					79	62	
Adair						1				7				
Andrew							16							
Atchison													19	
Audrain						12								
Barry												5		
Barton												12		
Bates												20		
Benton												4		
Bollinger											4			
Boone						40								
Buchanan							28							
Butler									9		7			
Caldwell							10							
Callaway						26								
Camden												6		
Cape Girardeau											26			
Carroll								2		7				
Carter											3			
Cass								32						
Cedar												3		
Chariton						2				7				
Christian												10		
Clark		11												
Clay								85						
Clinton							7							
Cole						16								
Cooper						5				7				
Crawford						11								
Dade												4		
Dallas												5		
Daviess							8							
De Kalb							8							
Dent	2													
Douglas	3													
Dunklin									9		4			
Franklin						42					16			
Gasconade						4								
Gentry							5							
Greene												59		
Grundy							5							
Harrison							13							
Henry												17		
Hickory												3		
Holt							19							
Howard										5				
Howell	15													
Iron											3			
Jackson							80	211						
Jasper												41		
Jefferson						42					13			
Johnson								14						
Knox										6				
Laclede												20		
Lafayette								35						
Lawrence												26		
Lewis						9								
Lincoln						13								
Linn							8			7				
Livingston							11							

	2028 Biodiesel Supply Sourcing by Demand Point for Figure 57 100,000 Gallon Units													
	Arkansas	Iowa	Kansas			Missouri							Nebraska	Tennessee
County	**Independence**	**Washington**	**Anderson**	**Morris**	**Riley**	**Audrain**	**Buchanan**	**Jackson**	**Pemiscot**	**Randolph**	**Scott**	**Vernon**	**Gage**	**Shelby**
Macon										6				
Madison											3			
Maries						19								
Marion						10								
McDonald												15		
Mercer							3							
Miller										6				
Mississippi											13			
Moniteau										5				
Monroe						6								
Montgomery						10								
Morgan										5				
New Madrid									10		10			
Newton												31		
Nodaway							11							
Oregon	3													
Osage						5								
Ozark	2													
Pemiscot									10		20			
Perry											8			
Pettis								12						
Phelps						14								
Pike						14								
Platte							62							
Polk												11		
Pulaski						13								
Putnam										4				
Ralls						9								
Randolph										6				
Ray								7						
Reynolds											2			
Ripley									3					
Saline								17		7				
Schuyler										4				
Scotland		7												
Scott											20			
Shannon	3													
Shelby						1				6				
St Charles						42					34			
St Clair												7		
St Francois											10			
St Louis	71	93				42		73			97			
St Louis City						42					67			
Ste. Genevieve											12			
Stoddard											20			
Stone												4		
Sullivan										5				
Taney	8													
Texas	10													
Vernon												17		
Warren						8								
Washington											4			
Wayne											7			
Webster												14		
Worth							2							
Wright												9		

8-State Biodiesel by Demand Point Flow Analysis for Missouri Scenario 2B, 2028 Data Table (for Figure 60)

Table 22 8-State Existing Biodiesel Plants Flow Analysis for Missouri Scenario 2B, 2028 Data Table (for Figure 60)

8-State Existing Biodiesel Plants Flow Analysis for Missouri Scenario 2B, 2028, Data Table for Figure 60

	Arkansas		Illinois			Iowa						Kansas		Kentucky	Missouri						Nebraska		Tennessee	
	Independence	**Phillips**	**Henry**	**LaSalle**	**Vermilion**	**Carroll**	**Clinton**	**Jasper**	**Sac**	**Washington**	**Woodbury**	**Anderson**	**Sedgwick**	**Daviess**	**Audrain**	**Buchanan**	**Jackson**	**Randolph**	**Pemiscot**	**Vernon**	**Douglas**	**Gage**	**Shelby**	**Grand Total**
Southern Out-of-State	38	59																	3				11	111
Eastern Out-of-State			3	2	101										41						75			222
Western Out-of-State									52		71	11	141			41	28			44				388
Western Out-of-State									53		70					123				44		98		388
Missouri																								
Adair															1			7						8
Andrew																16								16
Atchison																						19		19
Audrain															12									12
Barry																				5				5
Barton																				12				12
Bates																				20				20
Benton																				4				4
Bollinger																			3				1	4
Boone															40									40
Buchanan																28								28
Butler	13																		3					16
Caldwell																10								10
Callaway															26									26
Camden																				6				6
Cape Girardeau														11					3				12	26
Carroll																	2	7						9
Carter	1																		2					3
Cass																	32							32
Cedar																				3				3
Chariton															1			8						9
Christian																				10				10
Clark										11														11
Clay																	85							85
Clinton																7								7
Cole															16									16
Cooper															4			8						12
Crawford															11									11
Dade																				4				4
Dallas																				5				5
Daviess																8								8
De Kalb																8								8
Dent	2																							2
Douglas	3																							3
Dunklin																			3				10	13
Franklin	12														40					6				58
Gasconade															4									4
Gentry																5								5
Greene																				59				59
Grundy																5								5
Harrison																13								13
Henry																				17				17
Hickory																				3				3
Holt																19								19
Howard																		5						5
Howell	15																							15
Iron																			3					3
Jackson						25										40	181			45				291
Jasper																				41				41
Jefferson														14	41									55
Johnson																	14							14
Knox																		6						6
Laclede																				20				20
Lafayette																	35							35
Lawrence																				26				26
Lewis															9									9
Lincoln															13									13
Linn																8		7						15
Livingston																11								11
Macon																		6						6
Madison																			3					3
Maries															19									19
Marion															10									10
McDonald																				15				15
Mercer																3								3
Miller																		6						6
Mississippi																			3				10	13
Moniteau																		5						5
Monroe															6									6
Montgomery															10									10
Morgan																		5						5
New Madrid	5																		3				12	20
Newton																				31				31
Nodaway																11								11
Oregon	3																							3
Osage															5									5
Ozark	2																							2
Pemiscot	15																		2				13	30
Perry														6					2					8
Pettis																	12							12
Phelps															14									14
Pike															14									14
Platte																62								62
Polk																				11				11
Pulaski															13									13
Putnam								4																4
Ralls															9									9
Randolph																		6						6
Ray																	7							7
Reynolds	2																							2
Ripley																			3					3
Saline																	16	8						24
Schuyler																		4						4
Scotland										7														7
Scott														5					3				12	20
Shannon	3																							3
Shelby																		7						7
St Charles															41		35							76
St Clair																				7				7
St Francois															7				3					10
St Louis			5	111			23			66					40		113			18				376
St Louis City			4		4									60	41									109
Ste. Genevieve														9					3					12
Stoddard	5																		2				13	20
Stone																				4				4
Sullivan																		5						5
Taney	8																							8
Texas	10																							10
Vernon																				17				17
Warren															8									8
Washington															4									4
Wayne	4																		3					7
Webster																				14				14
Worth																2								2
Wright																				9				9
Grand Total	**141**	**59**	**12**	**113**	**105**	**25**	**23**	**4**	**105**	**84**	**141**	**11**	**141**	**105**	**500**	**420**	**560**	**100**	**50**	**500**	**75**	**117**	**94**	**3485**

8-State (with Scott County, MO plant) Biodiesel Flow Analysis for Missouri Scenario 2B, 2028, Data Table (for Figure 62)

Table 23 8-State (with Scott County, MO Plant) Biodiesel Flow Analysis for Missouri Scenario 2B, 2028 Data Table (for Figure 62)

8-State (with Scott County, MO plant) Biodiesel Flow Analysis for Missouri Scenario 2B, 2028, Data Table (for Figure 62)

	Arkansas	Illinois		Iowa					Kansas		Kentucky	Missouri							Nebraska	Tennessee	
	Independence	Henry	Vermilion	Clinton	Jasper	Sac	Washington	Woodbury	Anderson	Sedgwick	Daviess	Audrain	Buchanan	Jackson	Pemiscot	Randolph	Scott	Vernon	Gage	Shelby	Grand Total
Southern Out-of-State	8														9					94	111
Eastern Out-of-State		6	76									43					97				222
Western Out-of-State						8		70	11	141			25	74				59			388
Western Out-of-State						7		71					153					59	98		388
Missouri																					
Adair												1				7					8
Andrew													16								16
Atchison																			19		19
Audrain												12									12
Barry																		5			5
Barton																		12			12
Bates																		20			20
Benton																		4			4
Bollinger																	4				4
Boone												40									40
Buchanan													28								28
Butler															9		7				16
Caldwell													10								10
Callaway												26									26
Camden																		6			6
Cape Girardeau																	26				26
Carroll														2		7					9
Carter																	3				3
Cass														32							32
Cedar																		3			3
Chariton												1				8					9
Christian																		10			10
Clark							11														11
Clay														85							85
Clinton													7								7
Cole												16									16
Cooper												4				8					12
Crawford												11									11
Dade																		4			4
Dallas																		5			5
Daviess													8								8
De Kalb													8								8
Dent	2																				2
Douglas	3																				3
Dunklin															9		4				13
Franklin												42					16				58
Gasconade												4									4
Gentry													5								5
Greene																		59			59
Grundy													5								5
Harrison													13								13
Henry																		17			17
Hickory																		3			3
Holt													19								19
Howard																5					5
Howell	15																				15
Iron																	3				3
Jackson													26	226				39			291
Jasper																		41			41
Jefferson												43					12				55
Johnson														14							14
Knox																6					6
Laclede																		20			20
Lafayette														35							35
Lawrence																		26			26
Lewis												9									9
Lincoln												13									13
Linn													8			7					15
Livingston													11								11
Macon																6					6
Madison																	3				3
Maries												19									19
Marion												10									10
McDonald																		15			15
Mercer													3								3
Miller																6					6
Mississippi																	13				13
Moniteau																5					5
Monroe												6									6
Montgomery												10									10
Morgan																5					5
New Madrid															10		10				20
Newton																		31			31
Nodaway													11								11
Oregon	3																				3
Osage												5									5
Ozark	2																				2
Pemiscot															10		20				30
Perry																	8				8
Pettis														12							12
Phelps												14									14
Pike												14									14
Platte													62								62
Polk																		11			11
Pulaski												13									13
Putnam					4																4
Ralls												9									9
Randolph																6					6
Ray														7							7
Reynolds																	2				2
Ripley															3						3
Saline														16		8					24
Schuyler																4					4
Scotland							7														7
Scott																	20				20
Shannon	3																				3
Shelby																7					7
St Charles												42					34				76
St Clair																		7			7
St Francois																	10				10
St Louis		6	29	23			15				105	43		57			98				376
St Louis City												42					67				109
Ste. Genevieve																	12				12
Stoddard																	20				20
Stone																		4			4
Sullivan																5					5
Taney	8																				8
Texas	10																				10
Vernon																		17			17
Warren												8									8
Washington																	4				4
Wayne																	7				7
Webster																		14			14
Worth													2								2
Wright																		9			9
Grand Total	54	12	105	23	4	15	33	141	11	141	105	500	420	560	50	100	500	500	117	94	3485

Appendix E – Economic Impact of a Larger Missouri Biodiesel Industry Handout

BIODIESEL
Coalition of Missouri

ECONOMIC IMPACT

OF IMPLEMENTATION OF A B10 DIESEL FUEL STANDARD IN MISSOURI

Increasing production of existing plants by 43 million gallons per year and adding 53 million gallons of storage in Missouri would generate the following estimated total construction and operations effects to the local economy.

TOTAL EFFECTS (Operations for 1st Year)

JOBS	LABOR INCOME	VALUE ADDED	OUTPUT
498	$30.0 MILLION	$53.7 MILLION	$206.3 MILLION

OPERATIONS FOR 1ST YEAR[2]		
Impact Type	**Employment**	**Value Added**
Direct Effect	89	$18.3 million
Indirect Effect	276	$24.3 million
Induced Effect	133	$11.0 million
Total Effect	**498**	**$53.7 million**

CONSTRUCTION		
Impact Type	**Employment**	**Value Added**
Direct Effect	557	$12.1 million
Indirect Effect	107	$10.5 million
Induced Effect	227	$18.8 million
Total Effect	**891**	**$41.3 million**

TOTAL TAXES PAID (AT ALL JURISDICTIONS)					
Operations	$11.0 million	**Construction**	$12.5 million	**Combined**	$23.5 million

COMBINED EFFECTS OF CONSTRUCTION & OPERATIONS FOR 1ST YEAR				
Impact Type	**Employment**	**Labor Income**	**Value Added**	**Output**
Direct Effect	646	$42.7 million	$30.4 million	$174.3 million
Indirect Effect	383	$20.9 million	$34.8 million	$71.4 million
Induced Ef-fect	360	$17.0 million	$29.8 million	$53.3 million
Total Effect	**1,389**	**$80.6 million**	**$95.0 million**	**$298.9 million**

[1]To arrive at the total effects of a new biodiesel plant and increased production of existing plants, we used the following basic assumptions: 1) Existing biodiesel plants increase production by 43 million gallons per year 2) An average sales price of $3.47/gallon 3) Cost to construct new biodiesel plant with 10 million gallons of storage was $47.5 million 4) 53 million gallons of additional storage on biodiesel plants were needed to be constructed 5) All dollars are reported in 2024 dollars
[2]Totals may not sum due to rounding

BIODIESEL
Coalition of Missouri

ECONOMIC IMPACT

OF IMPLEMENTATION OF A B20 DIESEL FUEL STANDARD IN MISSOURI

A new biodiesel plant producing 50 million gallons per year and increasing production of existing plants by 43 million gallons per year in Missouri would generate the following estimated total construction and operations effects to the local economy.[1]

TOTAL EFFECTS (Operations for 1st Year)

JOBS	LABOR INCOME	VALUE ADDED	OUTPUT
1,076	$64.8 MILLION	$116.1 MILLION	$446.1 MILLION

OPERATIONS FOR 1ST YEAR[2]		
Impact Type	**Employment**	**Value Added**
Direct Effect	192	$39.6 million
Indirect Effect	596	$52.6 million
Induced Effect	288	$23.8 million
Total Effect	**1,076**	**$116.1 million**

CONSTRUCTION		
Impact Type	**Employment**	**Value Added**
Direct Effect	1,129	$27.4 million
Indirect Effect	227	$22.0 million
Induced Effect	469	$38.8 million
Total Effect	**1,825**	**$88.2 million**

TOTAL TAXES PAID (AT ALL JURISDICTIONS)					
Operations	$23.9 million	**Construction**	$25.9 million	**Combined**	$49.8 million

COMBINED EFFECTS OF CONSTRUCTION & OPERATIONS FOR 1ST YEAR				
Impact Type	**Employment**	**Labor Income**	**Value Added**	**Output**
Direct Effect	1,322	$89.0 million	$67.0 million	$376.0 million
Indirect Effect	823	$44.8 million	$74.6 million	$152.9 million
Induced Ef-fect	757	$35.8 million	$62.6 million	$112.0 million
Total Effect	**2,901**	**$169.5 million**	**$204.2 million**	**$640.9 million**

OVERVIEW: The entry of a new biodiesel plant producing 50 million gallons per year and increasing production of existing plants by 43 million gallons per year causes a measurable increase in economic activity within Missouri, both in terms of construction and annual operations. Common measures of economic activity are: Employment (jobs), Labor Income, Value-Added, and Output (sales). When a biodiesel plant enters a local economy, it causes a series of new economic activities (impacts) to take place. For this summary, economic impacts are broken into two categories: Construction (one-time impact) and Operations (annual impact). Construction and operations will generate tax revenue through federal taxes as well as state and local taxes. Of the estimated **$49.8** million generated in tax revenue, **$18.1** million is at the state and local level, and **$31.7** million at the federal level. The magnitude of these new economic activities are largely related to the presence of industries which supply the needed inputs for a biodiesel plant.

The construction of a new biodiesel plant requires purchases such as steel, concrete, and processing equipment. Once construction is completed, the biodiesel plant purchases vegetable oils, chemicals, utilizes other professional services, and purchases many other inputs to produce biodiesel for sale. The direct purchase of supplies and equipment are known as *direct effects*. The suppliers and vendors used by the biodiesel plant then must purchase inputs to supply the biodiesel plant; these are known as *indirect effects*. Those who work in the construction of the biodiesel plant, and for the suppliers and vendors then use their additional income to make household purchases; these are known as *household* or *induced effects*. Taken together, the sum of direct, indirect, and induced effects are known as total effects and accounts for the total multiplier effect present from the construction and annual operations of a new biodiesel plant.